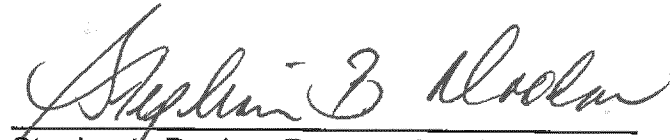


**Quality Assurance Project Plan for
Chromium (VI) Air Study
Kansas City, Kansas**

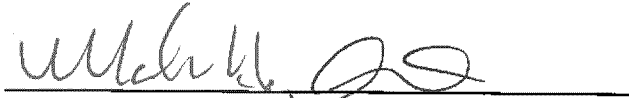
**U. S. EPA Region 7
Air Program
November 2011**


Stephanie Doolan, Program Lead
AWMD/APDB, EPA Region 7

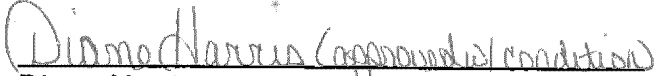
11/07/2011
Date


Leland Grooms, Technical Lead
ENSV/ASRS, EPA Region 7

11/15/2011
Date


Mark Smith, Chief
AWMD/APCO, EPA Region 7

11/17/11
Date


Diane Harris
Regional Quality Assurance Manager

11/28/2011
Date

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Appendix A

Figure 1 – Site Map & Proposed Air Sampler Location
Figure 2 – Air Modeling Results – Predicted Risk
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Appendix B

Eastern Research Group, Inc. Quality Assurance Plan

Appendix C

Standard Operating Procedure for Measurement of Hexavalent Chromium using the BGI PQ167R Low Volume Sampler, School Air Toxics Study, August 14, 2009

Appendix D

"Collection and Analysis of Hexavalent Chromium in Ambient Air," ERG, January 9, 2007

Appendix E

Region 7 Standard Operating Procedure No. 2314.06A, "Measurement of Hexavalent Chromium Using the BGI PQ167R Low Volume Sampler," November 7, 2011

A. Project Management

A3. Distribution List

Stephanie Doolan, Air Program Lead	AWMD/APDB, EPA Region 7
Leland Grooms, Technical Lead	ENSV/ASRS, EPA Region 7
Todd Phillips, Risk Assessment Support	ENSV/EAMB, EPA Region 7
Mike Jones, Analytical Contract Support	Office of Air Quality Planning Standards (OAQPS)
Julie L. Swift, Program Manager/Chemist	Eastern Research Group (ERG)
Miles Stotts, Air Program Lead	Kansas Department of Health & Environment (KDHE)

A4. Project/Task Organization

This project is being managed by the Air and Waste Management Division (AWMD), Air Planning and Development Branch (APDB), and administered by the Environmental Services Division (ENSV), Air Sampling and Services (ASRS) Branch, EPA Region 7. Field data collection, sample management, and reporting for the Chromium (VI) Air Study under this Quality Assurance Project Plan (QAPP) will be conducted by EPA Region 7. Air sample analysis will be conducted by Eastern Research Group, Inc. (ERG) under contract to the EPA's Office of Air Quality Planning and Standards (OAQPS) in Research Triangle Park, North Carolina.

EPA, Region 7

Stephanie Doolan, Program Lead
RCAP/AWMD (913) 551-7719

Responsibilities: Project management, laboratory coordination, and data validation and reporting

Leland Grooms, Technical Lead
EMWC/ENSV (913) 551-5010

Responsibilities: Receipt of sampling supplies, sample collection, shipment to laboratory, and data validation

Todd Phillips, Risk Assessment Support
ENSV/EAMB (913) 551-7438

Responsibilities: Developing site-specific action levels, sampling project design, technical support to program lead and field team

Mike Jones, Contract Officer Representative and Technical Support
OAQPS (919) 541-0528

Responsibilities: Contract fixed laboratory sample analyses, technical support

Julie Swift, Program Manager/Chemist
ERG (919) 468-7924

Responsibilities: Laboratory coordination including shipment of sampling supplies, sample management, quality assurance and data reporting

Miles Stotts
Kansas Department of Health and Environment
(785) 296-1615

Responsibilities: Act as a liaison with state regulatory agency.

A5. Problem Definition/Background

The purpose of this Quality Assurance Project Plan (QAPP) is to describe the procedures to be used for outdoor air sampling for hexavalent chromium [Cr(VI)] at a location in Kansas City, Kansas, predicted by modeling to represent the highest risk for human exposure. Outdoor air sampling is to measure Cr(VI) concentrations in ambient air in a residential neighborhood downwind from the source of the Cr(VI) emissions, and to determine whether further action is necessary to protect human health and the environment.

The source of the Cr(VI) emissions is the CertainTeed wool fiberglass manufacturing facility at 103 Funston Road, Kansas City, Kansas, in what is commonly known as the "Fairfax District." During the rule revision of the Wool Fiberglass National Environmental Standards for Hazardous Air Pollutants (NESHAP), CertainTeed conducted a stack test in November 2010 for Cr(VI). The stack test data, validated by CertainTeed in February 2011, indicate that the facility emits approximately 840 pounds of Cr(VI) per year combined from two process stacks known as the "K1stack" and "K2 stack." OAQPS notified Region 7 of this information in June 2011. The Cr(VI) is believed to be emitted by the facility from the degradation of high-chrome refractory brick inside the furnaces that melt the silica and other substrates to form the fiberglass.

Under high (3,000 degrees F) temperatures and a corrosive environment, the refractory brick degrades and Cr(VI), in the form of particulates, is emitted from the stacks that vent the kilns. By comparison, the next largest source of Cr(VI) in the wool fiberglass source category emits 56 lbs per year of Cr(VI).

Modeling was conducted by both OAQPS and Region 7 staff using AERMOD, EPA's preferred air dispersion model. Inputs to the model include five years of meteorological data (2006 – 2010) from Kansas City's Wheeler Airport, emissions data from the 2010 stack test conducted by CertainTeed, terrain and elevation data, and building and stack heights and dimensions to determine release heights of the Cr(VI) emissions and to evaluate potential "downwash" of contaminants from structures near the location the Cr(VI) is released. The outcomes of the model (Appendix A, Figures 2 and 3) indicate that the closest human receptors are in the Oak Grove Neighborhood to the southwest of the CertainTeed facility, that the Maximum Individual Risk (MIR) to the exposed population is approximately a 40-in-one-million (or 4×10^{-5}) cancer risk, and that the predicted maximum annual concentration averaged over five years (the number of years of meteorological data used to input the model) for Cr(VI) in the area of the Oak Grove Neighborhood is 2.4 nanograms per cubic meter (ng/m^3). For comparison, the EPA Air Program typically considers carcinogenic risks greater than 100-in-one-million (or 1×10^{-4}) to require further action. Based on EPA's Integrated Risk Information System (IRIS) database, the Region 7 toxicologists have recommended the following screening level for Cr(VI) listed in Table 1 below in outdoor air for a 70-year (e.g., lifetime) exposure.

Table 1. Cr (VI) Cancer Screening Levels¹

Risk Level	Screening Level (ng/m^3)	Modeled Concentration (ng/m^3) ²	Analytical Detection Level (ng/m^3)
100 in 1 Million	8	2.4	0.0039 ³
10 in 1 Million	0.8		
1 Million	0.08		

¹ - Assumes 70 year continuous exposure to outdoor (ambient) air

² - This value represents the modeled concentration at the closest human receptor.

³ - The Analytical Detection Limit listed is from the laboratory's Method Detection Limit (MDL) study which corresponds to 21.6 m^3 of air.

Table 2. Cr (VI) Non-Cancer Screening levels¹

Duration	Screening Level (ng/m^3)	Modeled Concentration (ng/m^3) ²	Analytical Detection Level (ng/m^3)
Chronic Exposure ($\geq 6 - 7$ years) ³	100	2.4	0.0039 ⁴

¹ - Assumes chronic/long-term continuous exposure. Generally applies to exposures greater than 6 to 7 years.

² - This value represents the modeled concentration at the closest human receptor.

³ - Source: EPA's Integrated Risk Information System (IRIS) chronic reference concentration (RfC) for particulates.

⁴ - The Analytical Detection Limit listed is from the laboratory's Method Detection Limit (MDL) study which corresponds to 21.6 m^3 of air.

Based on the predicted outcomes of the model and comparison with relevant human health screening criteria presented above, EPA intends to collect outdoor air data to confirm that the risk for the closest receptors does not exceed levels EPA has determined to be protective of human health. Note that for conservatism EPA is comparing the model predicted values for Cr(VI) to risk levels based on 70 years of continuous exposure. It is important to note that, based on available information, EPA believes that Cr(VI) emissions from the CertainTeed facility have only been elevated since 2004 when the facility reports that it re-bricked its furnaces with higher chrome content refractory brick.

In the initial phase of outdoor air sampling, EPA plans to collect multiple rounds of samples to determine the outdoor air concentration of Cr(VI) in the Oak Grove Neighborhood area, and to compare actual concentrations to the human health screening levels and predicted results of the model listed in Tables 1 and 2 above. Because wind direction and speed, relative humidity, and outdoor temperature can greatly affect the results of outdoor air sampling, EPA will initially collect samples at a frequency of one sample per every three days (1/3) from both of the collocated samplers for a period of six months. At the end of six months, EPA will evaluate the initial results and determine whether the frequency of sampling needs to be adjusted, the sampling needs to be continued, and if the number and location of samplers is appropriate. If the initial data indicate the need to adjust the sampling regime, this QAPP will be revised accordingly.

A public hearing and availability session is being planned for November 2011 to discuss the proposed Risk and Technology Review for Wool Fiberglass facilities, the new standards for Cr(VI) emissions from the CertainTeed facility, the results of EPA's risk modeling, and the plan to conduct this study to gather actual outdoor air data for Cr(VI) in the area of highest predicted risk for human receptors.

The former Garland Park Landfill is the selected location for sampling because it lies within the same contours for MIR and Cr(VI) concentration as the nearest residences, e.g., a measured concentration at the landfill is representative of Cr(VI) that may be measured at nearby residences. The former landfill site is open so that there are no obstructions from trees or buildings between samplers and the CertainTeed stacks emitting the Cr(VI), and it is fenced to limit access and tampering with the air samplers. Figure 1 in Appendix A depicts the proposed location of the air samplers. The Unified Government of Wyandotte County and Kansas City, Kansas, the current owners of the landfill property, have agreed to grant access for the sampling. At this time, discussions are occurring to determine whether electrical power for the samplers can be arranged or if the samplers will need to be powered by marine cycle batteries. Electrical power is preferable to battery power if possible due to the consistency in the power source, especially during cold winter months.

December 5, 2011

Analytical work will be performed by ERG, Inc., a contractor to OAQPS for air sample analysis. The laboratory's QAPP is provided as Attachment B. The analytical SOP for the specific analysis for Cr(VI) is proprietary; however, a copy will be made available to the Region 7 RQAM upon request. The analytical method for Cr(VI) is based on the California Air Resources Board (CARB) Method 039 and the paper provided as Appendix D titled, "Collection and Analysis of Hexavalent Chromium in Ambient Air," transmitted from ERG to Mike Jones, EPA OAQPS, in a letter dated January 9, 2007.

A6. Project/Task Description

The project is designed to:

- Measure concentrations of Cr(VI) in ambient air in areas where human exposures may occur;
- Assess whether exposure to Cr(VI) concentrations in outdoor air exceed human health risk-based criteria; and
- Determine whether further action is necessary.

To determine if exposure poses a potential human health risk, data will be compared with the risk-based screening levels presented in Tables 1 and 2 above, for cancer and non-cancer risks, respectively.

The data from this study will be submitted by the contract laboratory, ERG, to Mike Jones, EPA OAQPS, and Stephanie Doolan, EPA Region 7. If the average results for Cr (VI) over the first six months are found to exceed risk-based screening criteria listed above in Tables 1 and 2, further action may be deemed necessary. Further action could include, but is not limited to, additional sampling, an investigation of other possible sources of Cr (VI) in the surrounding area, and regulatory options, including enforcement, to reduce Cr (VI) emissions from the facility.

A7. Quality Objectives and Criteria for Measurement Data

By following the QAPP, the ERG contract statement of work, the EPA SOP, and the laboratory quality assurance plan, the quality objectives of this air sampling and analysis plan are to provide valid data of known and documented quality such that:

- Data will be collected in a manner to result in an accurate average annual 24-hour concentration of Cr(VI) in outdoor air;
- Data will be collected for comparison with risk based screening levels based on chronic/long-term exposure;
- Data will be used to determine the need for possible future actions; and
- Samples will be representative of seasonal and temporal variability of local meteorological conditions and operating conditions at the facility.

December 5, 2011

The data quality indicators to be used are identified below. Note that field collection best practices are detailed within the sampling SOP and methodology provided in Appendices C and E, and criteria for measurement data are embedded within the analytical methods.

- Representativeness will be addressed by collecting, analyzing, and reporting the data as described in this document, the attached SOP, and the analytical method.
- Comparability will be addressed by collecting, analyzing, and reporting the data as described in this document, the attached SOP and the analytical method.
- Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. The completeness objective for this project will be not less than 90%.
- Method accuracy will be assessed by laboratory analysis of calibration and control standards with known concentrations of the analyte of interest.

Method accuracy performance will be considered acceptable if daily quality control sample results fall within the normal range of acceptable values as indicated by the laboratory quality assurance plan (Appendix B). Sample specific and batch QA/QC will be reported in the data package received from the contract laboratory.

Field precision will be assessed by collection of collocated samples (two samplers located together). Field precision performance will be considered acceptable if sample results fall within +/- 70 Relative Percent Difference (RPD).

A8. Special Training Requirements/Certification

Experienced EPA air sampling personnel will be deployed to set up sampling equipment and retrieve samples for this project. Field personnel must be experienced in the operation of low volume particulate air samplers.

A9. Documentation and Records

The Program Lead is responsible for ensuring that the QAPP currently represents the sample collection activities in the field and that the most current version of the QAPP has been distributed to the list in Section A.3. For field documentation see section B3.

The records retention schedule for this project is as follows:

Function Code	Schedule	Disposition	Description
304-104-06	185a	Disposable 10 years after file closure	Collection of approved Quality Assurance Plans, QAPP
108-25-01-01-02	484a	Disposable 10 years after file closure	Data Records
305-109-01	258a(1)	Disposable 20 years after file closures	Final Deliverable and Reports

B. Measurement/Data Acquisition

B1. Sampling Process Design

To collect representative data great care must be taken during the field sampling to ensure proper purging, leak testing, and vacuum of the sample collection systems. Note that it is well reported in the literature that outdoor air samples have a high degree of variability. Factors that can influence air quality include distance from the source, source characteristics such as building dimensions and stack heights, topographic elevation of the source and receptors, and seasonal weather variations such as outdoor air temperature, wind speed and direction, and relative percent humidity.

As stated above, samples will be collected from two, collocated air samplers at a frequency of one per every three days, for a duration of a minimum of six months. The first phase of sampling will result in approximately 56 outdoor air samples (28 samples from each sampler). Initially, a minimum of 20 field blanks will be collected. Depending on the results of the initial 20 field blanks, as discussed above, the number of field blanks collected may be reduced. For the purposes of this QAPP, it is estimated that field blanks will be collected biweekly, for a total number of 24. The project team will evaluate the data after six months and decide whether to continue, reduce or expand the study.

The Technical Lead will be responsible for identifying and implementing any corrective action in the field, and as a part of sample handling and shipment. All corrective actions taken must be documented in the field logbook. Issues and corrective action taken that affect the quality and usability of the data must be reported to the Program Lead to ensure that data are validated appropriately and usability is considered as a part of decision making.

B2. Sampling Methods Requirements

Samples will initially be collected from two collocated low volume particulate air samplers in accordance with Appendix E, "Measurement of Hexavalent Chromium Using the BGI PQ167R Low Volume Sampler (U. S. EPA, 2011), which is based on Appendix C, "Standard Operating Procedure for Measurement of Hexavalent Chromium using the BGI PQ167R Low Volume Sampler, School Air Toxics Study," (U. S. EPA 2009). Per the study conducted by ERG (Appendix D), the following sample preservation procedures need to be employed:

- Teflon filters must be used to collect the samples;
- Filter media must be pre-washed with acid and rinsed before coating with sodium bisulfate to prevent Cr(VI) background interference;
- Samples must be retrieved within 24-hours after collection to prevent sample loss; and
- All samples must be delivered to the laboratory frozen to reduce sample loss.

The Technical Lead is responsible for ensuring that these field procedures are strictly adhered to, and documenting and reporting any deviations from these procedures that may affect data quality and usability.

B3. Sample Handling and Custody Requirements

Sample containers, preservation, and holding times will be those found in the EPA SOP (Appendix C) and the procedures listed in B.2 above that are from the "Collection and Analysis of Hexavalent Chromium in Ambient Air," transmitted from ERG to Mike Jones, EPA OAQPS, in a letter dated January 9, 2007 (Appendix D).

Chain-of-Custody documentation will be recorded on the form provided by ERG similar to the example provided on page 19 of the SOP found in Appendix C. This form also records the date and time of collection, location, total sampling time, meteorological conditions, and air sample volume. The field team will record this information and other site-specific observations in a field logbook using indelible ink.

B4. Analytical Methods Requirements

Air sample analysis for Cr(VI) will be conducted by ERG in accordance with a modified CARB SOP 039 in accordance with ERG's quality assurance plan. This analytical method employs the use of both Ion Chromatography (IC) and Inductively Coupled Plasma-Mass Spectrometry (ICP-MS). Results from this study will be compared to the cancer and non-cancer risk screening values as provided in Tables 1 and 2 above. As noted above, the SOP for the method is proprietary; however, it will be made available to EPA personnel upon request.

Correction action for analytical quality control issues is the responsibility of the laboratory to conduct in accordance with its Quality Assurance Plan (Appendix B). However, it is the responsibility of the Laboratory Program Manager/Chemist to inform the Program Lead of issues requiring corrective action, actions taken and the affect, if any, on the analytical data reported.

The turnaround time for sample analysis is 30 days from sample receipt, per the laboratory's contract.

B5. Quality Control Requirements

Collocated samples and trip blanks will be collected during the project. Two collocated samples will be collected on each day of sampling. The collection of two collocated samples will provide measurement of sampling precision and environmental variability.

Field blanks (sample media handled, exposed to outdoor air briefly, and shipped to the contract laboratory for analysis along with the collocated field samples) will be prepared and analyzed initially at a frequency with every shipment of field samples to the laboratory. The field blanks will be used to assess sampling accuracy and the potential for cross-contamination to occur during sample handling and shipment. As the study progresses, the frequency of field blank preparation and analysis may be reduced to biweekly if the following conditions are met: 20 trip blank samples have been submitted for analysis and the results are less than field sample results; the collocated field sample data do not indicate the potential for cross-contamination of samples; and the laboratory blank sample results analyzed as a part of the batch including the field samples indicate no significant laboratory contamination issues.

Laboratory quality control elements, including spikes and blanks will be performed in accordance with the ERG quality assurance plan (Appendix B).

B6. Instrument/Equipment Testing, Inspection, and Maintenance Requirements

The field equipment instrumentation testing, inspection, and maintenance will be performed in accordance with the field SOPs (Appendix C). Analytical instrumentation testing, inspection, and maintenance will be performed in accordance with the ERG quality assurance plan (Appendix B).

B7. Instrument Calibration and Frequency

Field equipment and analytical instrument calibrations will be performed in accordance with the appropriate referenced analytical or sample collection SOP and manufacturer's recommendations. Analytical instrumentation calibration will be performed in accordance with the ERG quality assurance plan (Appendix B).

B8. Inspection/Acceptance Requirements for Supplies and Consumables

The Technical Lead will be responsible for receipt and inspection of sample media and containers for return shipment to the laboratory. As described in B.2 above, the sample media need to be shipped to the field coated with sodium bisulfate. Rejection of sampling media and supplies needs to be reported to Mike Jones, OAQPS, with a copy to the Program Lead, because these are contract requirements that must be resolved by the EPA Contracting Officer for the analytical contract with ERG.

B9. Data Acquisition Requirements

Acquired data for this project include modeling results that were generated using an EPA-approved model, AERMOD, using protocols that are established in 40 CFR Part 58, Appendix W. Thus, the quality and reliability of the modeling is assured by using an approved model and following a prescriptive process.

B10. Data Management

Analytical data management will be in accordance with EPA's national contract for air sample analysis with ERG. Data will be reported both to Mike Jones, the EPA Contract Officer Representative, and Region 7's Program Lead. The Program Lead will review and validate the data, and transmit it to the project team for further review and analysis.

C. Assessment/Oversight

C1. Assessments and Response Actions

The EPA Region 7 QA Manager (RQAM) or designee may conduct an audit of the field activities for this project if requested by the EPA Program Lead or Technical Lead. The EPA RQAM will have the authority to issue a stop work order upon finding a significant condition that would adversely affect the quality and usability of the data. The EPA Technical Lead will have the responsibility for initiating and implementing response actions associated with findings identified during the on-site audit. Once the response actions have been implemented, the EPA RQAM will perform a follow-up audit to verify and document that the response actions were implemented effectively.

C2. Reports to Management

A six-month technical report will be prepared by the Program Lead and Technical Lead with support from the Regional Risk Assessor. The report shall incorporate the results from EPA air sampling and shall be distributed in accordance with section A3. The six-month report will contain environmental sampling results and will compare the results with the respective human health risk-based levels. The six-month report will also recommend whether additional sampling is needed.

D. Data Validation and Usability

D1. Data Review, Validation, and Verification Requirements

The data will be reviewed and reported by the contract laboratory in accordance with its procedures documented in the quality assurance plan (Appendix B). The EPA Program Lead and Technical Lead will be responsible for overall validation and final approval of the data in accordance with project purpose and use of the data.

D2. Validation and Verification Methods

ERG, the contract laboratory performing the analysis will input the data to EPA's Air Quality System (AQS). AQS contains outdoor air data collected by EPA, state, local, and tribal air pollution control agencies from thousands of monitoring stations. AQS also contains meteorological data, descriptive information about each monitoring station (including its geographic location and its operator), and data quality assurance/quality control information. OAQPS staff review and validate AQS using air program guidelines before release on the publically available portion of the AQS website.

The EPA Program Lead and Technical Lead will perform the final review and approval of the data prior to it being reported to the project team for decision making. The final review will consist of verifying that the sample collection and analyses were performed in accordance with the approved QAPP, and the SOPs provided in Appendices C and E. Final review and validation will include a review of the results of the collocated samples and trip blanks to ensure they are acceptable and have met precision and accuracy goals set forth in this QAPP. The final review will also compare the sample descriptions with the chain-of-custody/field sheets for consistency and will ensure that any anomalies in the data are appropriately documented.

D3. Reconciliation with User Requirements

Once the results are compiled, the EPA Program Lead and Technical Lead will review the results from collocated samples and trip blanks to determine if they fall within the acceptance limits as defined in this QAPP. Completeness will also be evaluated to determine if the completeness goal for this project has been met (> 90%). If data quality indicators do not meet the project's requirements as outlined in this QAPP (including the accuracy for lab spikes), the data may be discarded and re-sampling may occur. The EPA Program Lead and Technical Lead will evaluate the cause of the failure (if possible) and make the decision to discard the data and re-sample. If the failure is tied to the analysis, calibration and maintenance techniques will be reassessed as identified by the appropriate lab personnel. If the failure is associated with the sample collection and re-sampling is needed, sampling personnel will be retrained or the sampling method modified accordingly to correct the problem.

Data will be compared with meteorological data from the Kansas City Downtown Airport, looking particularly at the data when the predominant wind direction is from the source and toward the samplers. Results for dates when the wind direction is toward the monitors will be compared with the model predicted results. At a minimum, the average, maximum and minimum results will be reported by month and for the duration of the sampling program.

The data from dates when the predominant wind direction is not toward the samplers will be examined to determine whether the CertainTeed facility is the only source of Cr(VI) emissions in the area, or if there are other possible sources unknown to EPA at this time. Should the data indicate other potential sources of Cr(VI), EPA may adjust the number and location of samplers deployed as a part of this study, and/or, in consultation with KDHE, will conduct a more rigorous review of emissions inventory data and industrial classifications for facilities that may be contributing to measured levels of Cr(VI) in outdoor air.

APPENDIX A

FIGURES

FIGURE 1 - LOCATION MAP & PROPOSED SAMPLER LOCATION



Figure 2 Maximum Individual Cancer Risk (MIR)
Chromium (VI) Air Study
October 2011



Presumptive Limit on Maximum Individual Risk = 100 in a million
Risk assumes continuous 70 year exposure

Figure 3 Ambient Cr (VI) Concentrations (ng/m3)
 Chromium (VI) Air Study
 QAPP Rev. 0 October 2011

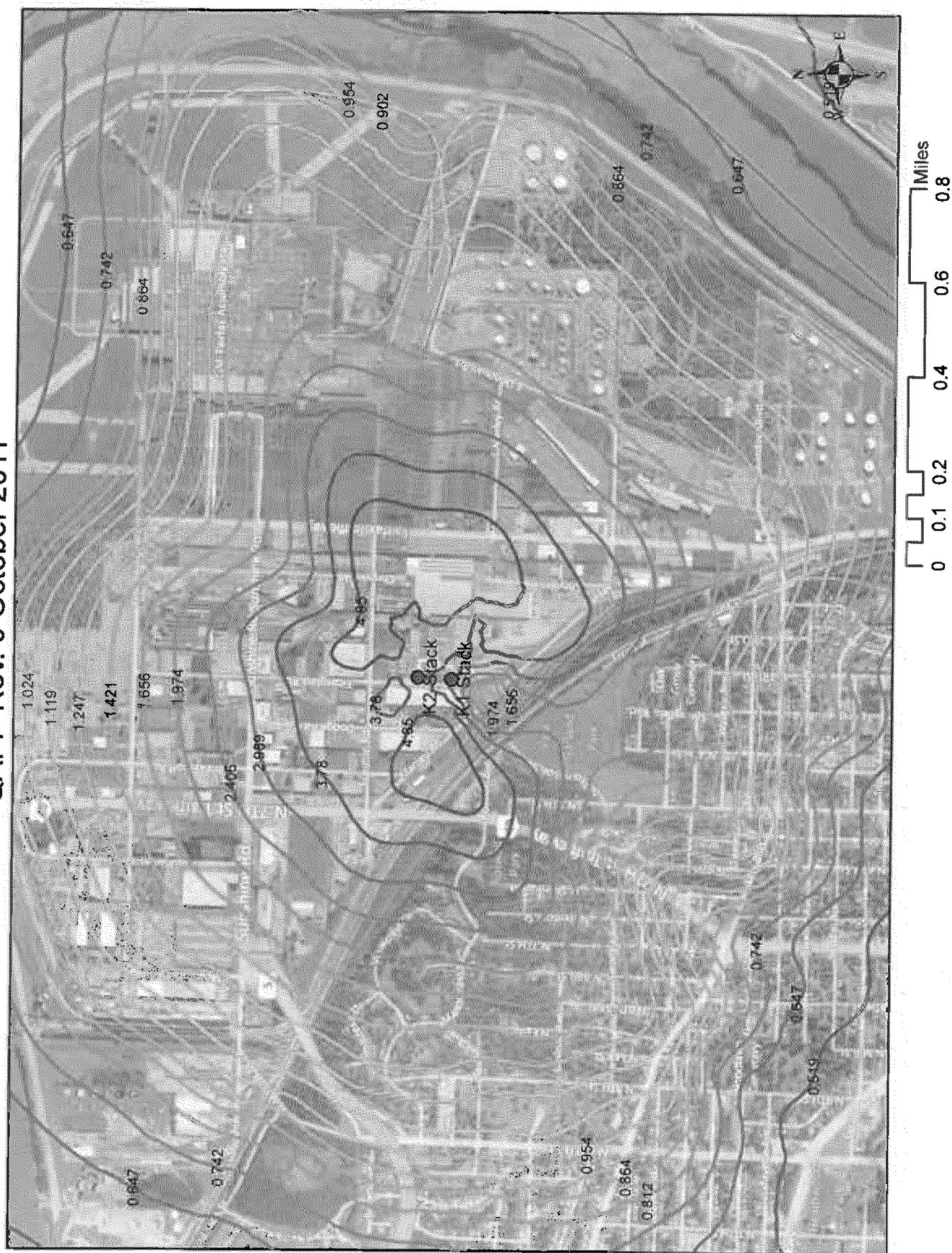
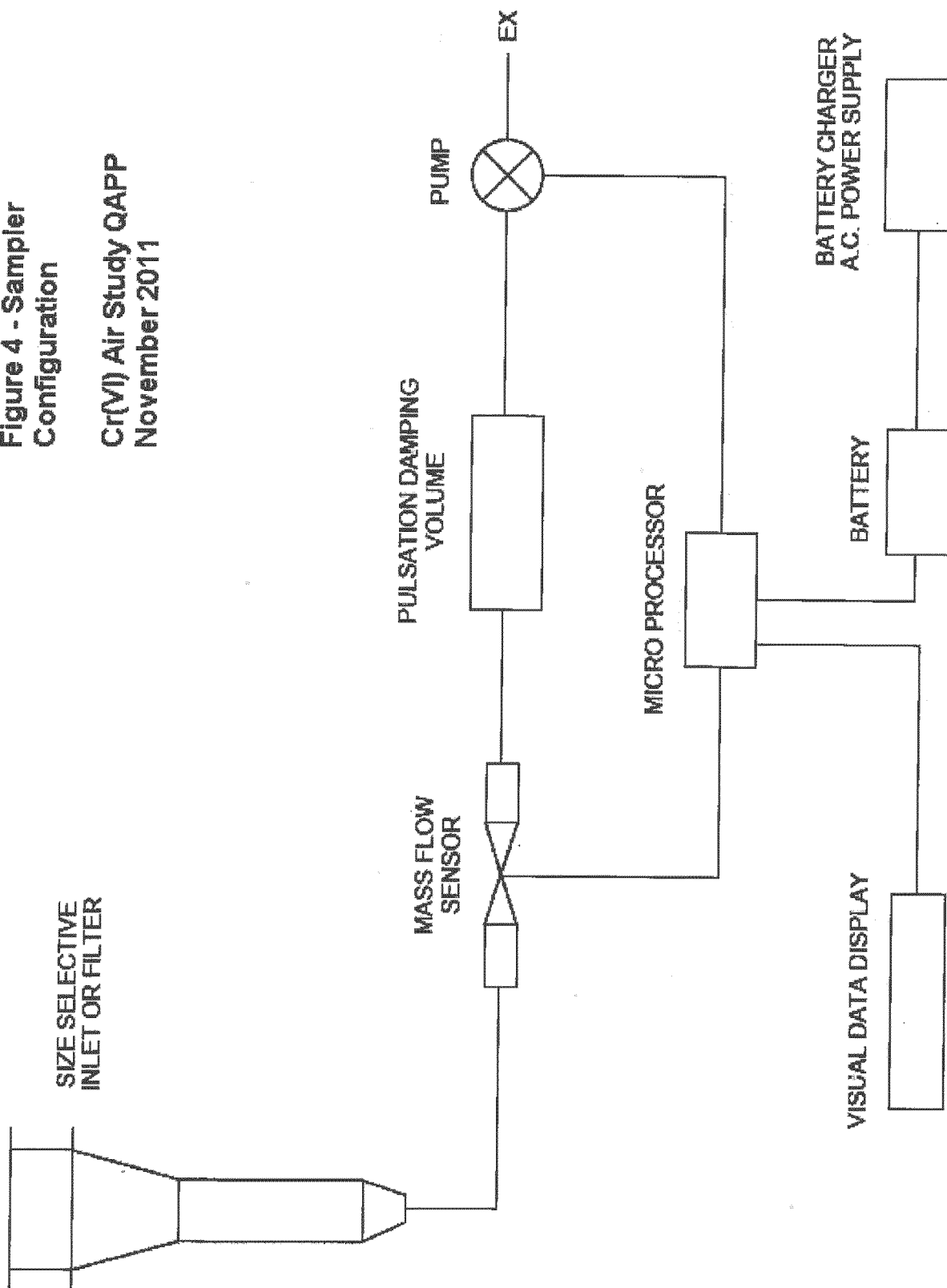


Figure 4 - Sampler Configuration
Cr(VI) Air Study QAPP
November 2011



APPENDIX B

2011 ERG LABORATORY QUALITY ASSURANCE PLAN

APPENDIX C

**STANDARD OPERATING PROCEDURE
FOR
MEASUREMENT OF HEXAVALENT CHROMIUM
USING THE
BGI PQ167R LOW VOLUME SAMPLER
(U. S. EPA, 2009)**

**STANDARD OPERATING PROCEDURE
FOR
MEASUREMENT OF HEXAVALENT CHROMIUM
USING THE
BGI PQ167R LOW VOLUME SAMPLER**



**U.S. Environmental Protection Agency
Region 4, Science and Ecosystem Support Division
Athens, Georgia, 30605**

Acknowledgement

This Standard Operating Procedure (SOP) was developed by EPA Region 4, Science and Ecosystem Support Division. This SOP is based on the Commonwealth of Kentucky's ambient monitoring SOP template. Special thanks to BGI Inc. and ERG for operational content and illustrations.

For questions or comments please contact:

Greg Noah, EPA, Region 4, SEDS at noah.greg@epa.gov or 706-355-8635
Mike Jones, EPA-OAQPS-AQAD at jones.mike@epa.gov or 919-541-0528

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I. INTRODUCTION

This procedure is designed to provide instruction on collecting hexavalent chromium (Cr+6) in air using the BGI PQ167R air sampler for metals analysis.

The BGI PQ100 is an "Intelligent Air Pump" that can monitor its own airflow rate and thereby adjust the pump speed to compensate for changes in load pressure and/or other forces which would otherwise hamper the flow of air through a filter (or sample collector). The PQ100 unit can be programmed to begin its sampling job at a specific date, time, and stop sampling after the user defined run time is depleted. However, the sampling time should always be 24 hours for Cr+6 sampling the Toxics in Schools Study.

The PQ100 was designed to operate from 1 standard liter per minute (1000 cc per minute) to 25.0 standard liters per minute and is unaffected by changes in ambient temperature and barometric pressure. The flow rate precision is guaranteed to 2% of the calibration set point.

This SOP is designed to be a step by step method for operating the sampler to be used in conjunction with the manufacturer's operators manual. Laboratory Analysis Methodology may be referenced by contacting the Eastern Research Group (ERG) directly at 919-468-7800 or by email Julie.Swift@erg.com. Maintenance and troubleshooting should be conducted using the BGI167R operator's manual.

FIGURE 1. Schematic of PQ167 Sampling System
(Cr+6 filter holder apparatus replaces PM10 inlet head)

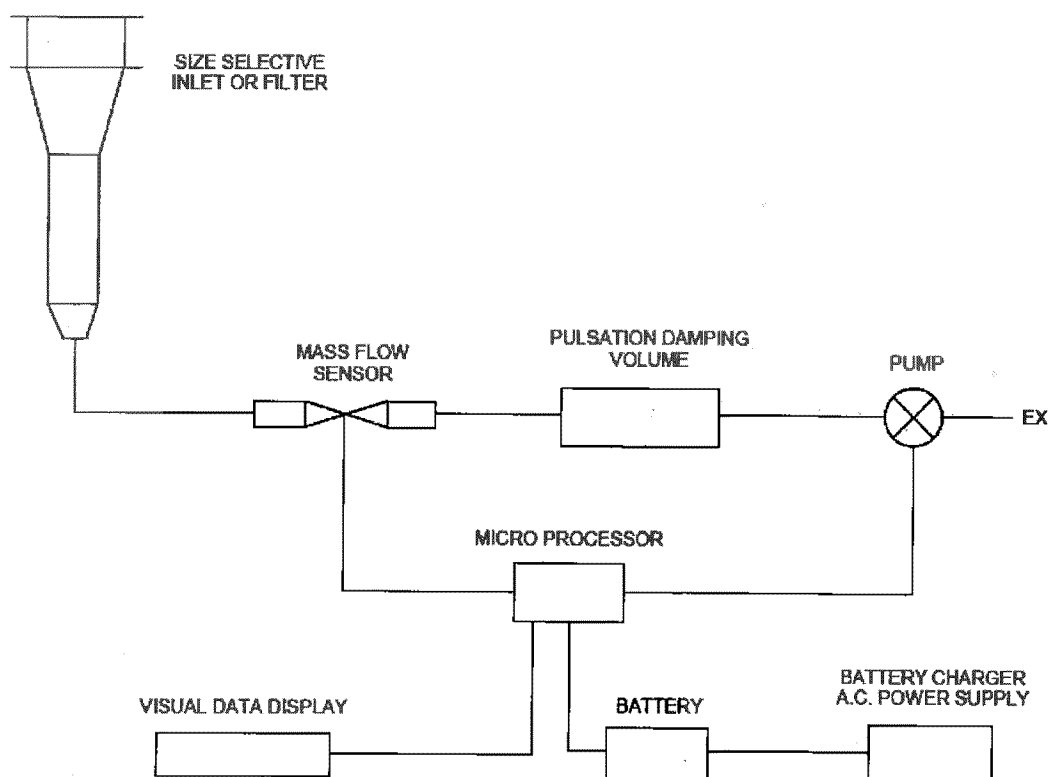
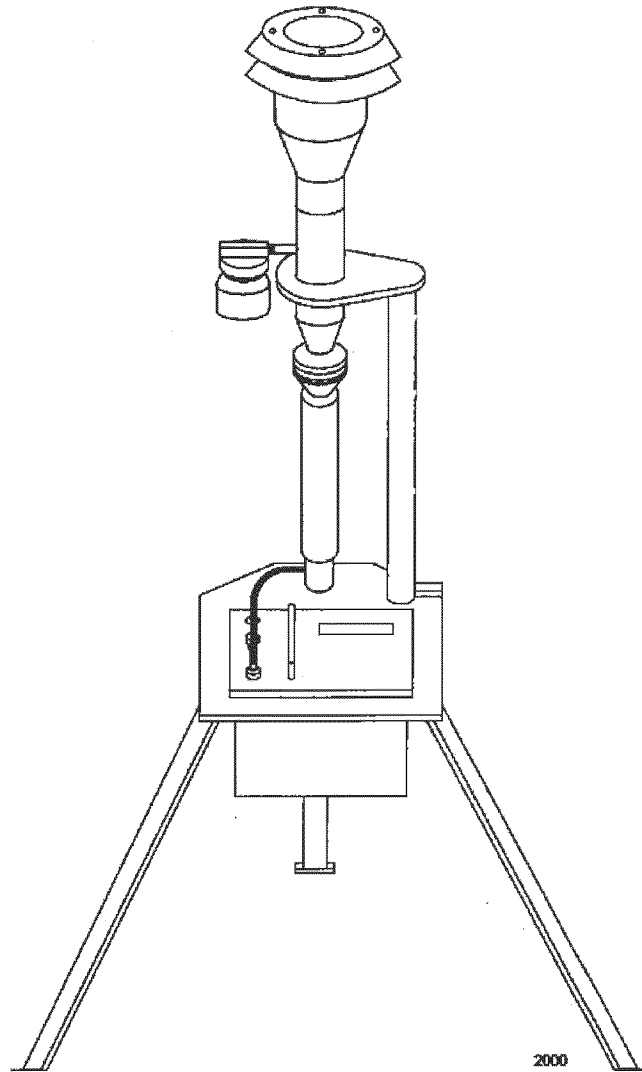


FIGURE 2. PQ167R with Mounting Stand
(Cr+6 filter holder apparatus replaces PM10 inlet head and filter cassette module
and downtube assembly brace are not used)



II. INSTALLATION

A. Sampler Siting

Check the areas for safety. Ensure there will be enough room for the operator to move freely while working, and ensure physical conditions of the location will allow the operator to work safely.

The sampler should be set in a location unobstructed from any side. No tree limbs or other hanging obstructions should be above the sampler. It is suggested that the horizontal distance from the sampler to the closest vertical obstruction higher than the sampler be at least twice the height of the vertical obstruction. There should be no sources located nearby that may bias sampling measurements.

Locate the sampler on a reasonably level structure at a height between two (2) and fifteen (15) meters above the ground.

B. Sampler Installation

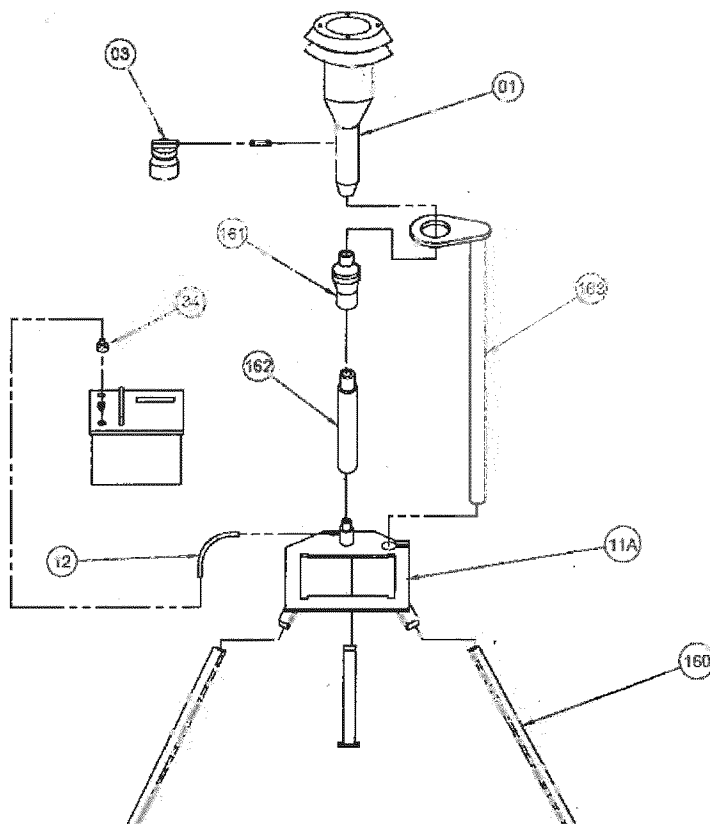
Assemble the sampler according to Figure 3 below omitting the installation of the PM10 inlet head, filter cassette holder assembly, and downtube assembly brace. For detail and illustration, refer to the BGI PQ167 Quick Start document, pages 2 through 8.

Cr+6 Retrofit Instructions

1. The sampling unit, at this point, should have legs mounted on the stand, and the pump and power components should be secured in the stand according to the PQ167 Quick Start document. The downtube, PM10 inlet head, and filter cassette holder assembly should NOT be installed.
2. Install the downtube on the top of the cylindrical mount on the stand. The mount should have tubing leading from the port on its side to the inlet on the pump module.
3. The total ERG Cr+6 filter holder apparatus consists of a BGI flow adapter with shut-off valve, stainless steel connector fitting, a length of "U" shaped stainless steel ¼ inch tubing, ERG filter assembly, and a glass funnel. **The ERG filter assembly and glass funnel will be provided for each sampling run and should not be installed until a sampling run is setup.** Place this apparatus (without ERG filter assembly) on the top of the downtube, and ensure that the shut-off valve is in the open position.

4. The open end of the stainless steel tubing should be capped when sampling is not in progress to prevent contamination.

Figure 3. Sampler Assembly Diagram
(Cr+6 filter holder apparatus replaces PM10 inlet head and filter cassette module and downtube assembly brace are not used)



- | | |
|-----|---------------------------------|
| 01 | PM10 Inlet head |
| 03 | Water collection bottle |
| 11A | Tripod frame |
| 12 | Rubber hose |
| 34 | Hose adapter |
| 160 | Sampler leg |
| 161 | Filter cassette holder assembly |
| 162 | Downtube |
| 163 | Downtube assembly brace |

Place and level the sampler on site. To secure the sampler and protect membrane roofs, 2 x 4 wooden studs may be cut into one foot sections and fastened to the feet of the legs using lag bolts. Place sand bags on these skids to prevent tipping of the sampler.

Connect the sampler to a grounded electrical outlet with 115 volts, and at least 5 amp service. Protect the connector from precipitation by fastening beneath the sampler or wrapping it with plastic tape.

If operating using a deep cycle marine battery for power, install the external power cord by screwing the round harness into the "utility adapter" port on top of the sampler. Attach the positive and negative contacts to the deep cycle marine battery and secure. A fully charged battery should provide power for at least 2 sampling runs. Depending on the battery available, more consecutive runs may be possible. Store the battery in a plastic container near the sampler to conceal and protect it from the weather.

If collocated samplers will be located at the site, the two samplers must be within four (4) meters of each other, but outside of two (2) meters. The inlet heights must be within one (1) meter vertically.

III. OPERATING PROCEDURE

A. Equipment and Supplies

BGI PQ167R
ERG Cr+6 filter holder apparatus
Flow calibrator
Logbook
ERG filter assembly with glass funnel
Cooler with ice substitute
Powderfree gloves
ERG sample paperwork

B. Sampler and Sample Media Receipt Activities

1. Plug sampler into AC power and charge the internal battery for at least 24 hours.
2. Check parts and components against the packing list.
3. After charging, ensure sampler will power up and that the main screen is operational.
4. The sampler may arrive with a default flow rate of 16.7 Lpm. If

during the initial verification, the sampler's target flow rate is displayed as 16.7 Lpm, it must be changed to 15 Lpm. Proceed directly to the calibration section of the SOP for direction in making the change.

5. The ERG Cr+6 Filter Holder Modules will arrive to the field office in a cooler with frozen ice substitutes. The modules will have paperwork designating them for a specific site and run day. **The modules must be kept in a freezer prior to sampling and kept cold during transport to the monitoring site for run preparation.**
6. It is highly recommended that there be as little time as reasonably possible between preparing the sampler for the next run (i.e. loading the sample media); the day prior is optimal.
7. **Samples must be retrieved the day following sampling, preferably NLT NOON LST, and returned to ERG cold using the ice substitutes provided.**

C. Verification

NOTE: THE PQ100 DOES NOT REQUIRE A LEAK TEST. CUTTING OFF THE FLOW OF AIR BY COVERING OR RESTRICTING THE AIR FLOW TO THE INLET WILL CAUSE DAMAGE TO THE INTERNAL PUMP AND WILL VOID THE WARRANTY.

To VERIFY flow:

1. Install a test ERG Cr+6 filter holder module if available. If a test module is not available, the module to be used for the next sample day is acceptable; however, the module must be used immediately following the verification/calibration.
2. Attach a NIST traceable flow standard to the inlet of the filter module. Ensure the flow standard is on and has equilibrated to ambient conditions.
3. Turn on the PQ167R by pushing the "ON/OFF" button. If a message is blinking on the display, press "ENTER" to proceed to the "MAIN IDLE DISPLAY".

The screen display should read:

ET0000Min TS00.00M (Date)
Q(Flow)Lpm T(Time) Bty(Capacity)%

(Date) – today's date in military notation; e.g., 01JAN= January 1st

(Flow) - the current flow rate selected to be regulated.

(Time) - military time; e.g., 13:08= 13 Hours 8 Minutes or 1:08 PM

(Capacity) - remaining charge in the internal battery.

4. Press SETUP three times until the Set START DATE and TIME screen appears: The screen should appear as below:

Set START DATE and TIME
(Date) (Time) Off

5. The word, "Off", should be displayed in the lower right corner of the screen. The bottom line of the display should be flashing. If "On" is displayed, press the "ENTER" button until "On" stops flashing. Then toggle to "Off" by pressing the + or - buttons.
6. Press the "SETUP" button twice to get to the "MAIN IDLE DISPLAY"
7. Press the "RUN/STOP" button to activate the pump.
8. Allow the pump to stabilize for at least 2 minutes.
9. If the measured flow and the flow indicated on the flow standard are within 4%, the sampler's calibration is acceptable. If the flow is outside 4%, the unit must be recalibrated.
10. Press the "RUN/STOP" button to turn off the pump.

D. Calibration

NOTE: THE PQ100 DOES NOT REQUIRE A LEAK TEST. CUTTING OFF THE FLOW OF AIR BY COVERING OR RESTRICTING THE AIR FLOW TO THE INLET WILL CAUSE DAMAGE TO THE INTERNAL PUMP AND WILL VOID THE WARRANTY.

To CALIBRATE flow:

1. Install a test ERG Cr+6 filter holder module if available. If a test module is not available, the module to be used for the next sample day is acceptable; however, the module must be used immediately following the verification/calibration.
2. Press "SETUP". The screen will read; "Select FLOW RATE"
3. From the "MAIN IDLE DISPLAY" press the "Setup" key once until the message below appears;

Select FLOW RATE

The Target Q should read 15.0 Lpm. If it does not read 15.0 Lpm, set TARGET FLOW RATE to 15.0 Lpm by pressing ENTER. The whole number value will remain on constant while the tenths still blink); use "+" or "-" to increase or decrease until 15 is displayed. Press ENTER (Tenths value will now remain constant while whole number blinks); use "+" or "-" to increase or decrease until .0 is displayed.

4. From the "Select FLOW RATE" message screen, press both the "Reset" key and the "Run/Stop" key simultaneously to enter the calibration mode and the message below will appear;

CALIBRATE Target=15.0 Lpm

5. Press the "RUN/STOP" button to activate the pump and the message below will appear:

CALIBRATE Target = 15.0 Lpm
Reference Q.. XX.X

The Reference Q is an approximate flow rate used only as a visual aid in finding the corrected flow on the calibration device. This value may indicate 5 to 15% error. This is for reference only!

6. Use the "+/-" keys to move the pump speed up or down until the calibration device indicates the desired flow rate.
7. When a stable reading has been achieved, press the "ENTER" key to store the flow rate.
8. Exit the Setup menu and return to the "MAIN IDLE DISPLAY". CALIBRATIONS ARE NOT AFFECTED UNTIL THE ENTER KEY IS PRESSED AND THE PUMP IS RUNNING.
9. Record pre- and post- flow measurements and adjustments in the logbook.

E. Conducting the Sampling Event

Site Arrival Daily Activities

1. Visually inspect and ensure all O-rings are in place and secure. Replace if necessary.

2. Always ensure that samples and unused ERG Cr+6 Filter Holder Modules are transported to and from the site cold.
3. Confirm all cables (electrical connections) are secure, and that exterior connections are protected from the elements.
4. Record activities, site observations, and maintenance activities in logbook.

Preparing Sampler for a Sampling Event

1. Prepare sample paperwork. On the ERG AMBIENT HEXAVALENT CHROMIUM DATA SHEET, complete the "Lab Pre-Samp." and "Field Setup" sections. Record any pertinent observations in the notes section at the bottom of the form.
2. Turn on the PQ167R by pushing the "ON/OFF" button. If a message is blinking on the display, press "ENTER" to proceed to the "MAIN IDLE DISPLAY". Then press "RESET" to clear prior run data.
3. Conduct an initial flow check (verification) by following the instructions in section C. **Verification**. Record the measurement from the flow standard on the ERG AMBIENT HEXAVALENT CHROMIUM DATA SHEET under the "Field Setup" section on the "Initial Rotameter Setting".
4. Following the flow check, the screen display should read:

ET0000Min TS00.00M (Date)
Q(Flow)Lpm T(Time) Bty(Capacity)%

(Date) – today's date in military notation; e.g., 01JAN= January 1st
(Flow) - the current flow rate selected to be regulated.
(Time) - military time; e.g., 13:08= 13 Hours 8 Minutes or 1:08 PM
(Capacity) - remaining charge in the internal battery.
5. Press "SETUP". The screen will read; "Select FLOW RATE"
The flow rate value will be blinking.
6. The flow rate should read 15.0 Lpm. If it does not read 15.0 Lpm, the unit must be calibrated to 15.0 Lpm. See calibration section for adjusting target flow rate and calibration.
7. Press "SETUP". This is the date and time screen.

The screen should read;

Set DATE and TIME
(dd) (mmm) (yyyy) (time)

To change the Date and Time;

TIP: Only the field not blinking can be adjusted. Push enter to move to the next field.

- a. DAY: Press ENTER and change by pressing the + or - key. When the day is correct, press ENTER.
 - b. MONTH: To change, press + or - key. When correct, press ENTER.
 - c. YEAR: To change, press + or - key. When correct, press ENTER.
 - d. TIME (hrs): To change, press + or - key. When correct, press ENTER.
 - e. TIME (min): To change, press + or - key. When correct, press ENTER.
8. When date and time are correct press "SETUP"
 9. This is the sample start screen which reads;

Set START DATE and TIME
(dd) (mmm) 00:00 Off

This screen allows you to set a start date and time for a sampling run. The default is set to midnight the next day. To designate your own start date and time:

- a. DAY: Press ENTER and change by pressing the + or - key. When the day is correct, press ENTER.
- b. MONTH: To change, press + or - key. When correct, press ENTER.
- c. YEAR: To change, press + or - key. When correct, press ENTER.
- d. TIME (hrs): To change, press + or - key. When correct, press ENTER.

- e. TIME (min): To change, press + or - key. When correct, press ENTER.
- f. Enable the run by setting the "On/Off" function on the screen to "On".

WARNING: The sampler will not automatically activate if this option is set to "Off".

10. Press "SETUP"

The screen will read;

Set RUN TIME
Hours: 24 Min: 00 On

Set to 24 hours 0 minutes. The default is always 24 hrs 0 min, the required sample duration. If the sample time needs to be modified, adjust as instructed in step 6 and 8.

11. Press "SETUP". The screen will return to the "MAIN IDLE DISPLAY"

WARNING: DO NOT PRESS THE RESET BUTTON AT THIS TIME AS THE START TIME AND RUN TIME WILL DEFAULT.

12. Press "RUN/STOP"

If the START TIME ENABLE is set to "On" then the message "Alarm Triggered Run..." followed by "PQ100 Powering Down.." will appear briefly. The PQ100 is now waiting for the internal real time clock to achieve the designated start time and will then power itself on and begin the sampling run. If the START TIME ENABLE is set to "Off" then the pump will begin to run immediately. If this occurs, press RUN/STOP and begin back at step 2 ensuring START TIME ENABLE is set to "On".

Installing the ERG Cr+6 Filter Holder Module

NOTE: Gloves must be changed for each sample, i.e. between retrieving a sample and preparing a new run gloves MUST be changed to prevent cross contamination.

- 1. Remove the sample inlet cover on the stainless steel probe and make sure there is no contamination on the probe.

2. Put on a clean pair of powderfree gloves
3. Take the ERG Cr+6 Filter Holder Module storage container from the cooler and carefully remove the module. The module may be in a plastic bag. Return the bag to the container for use in the collection procedure.
4. Make sure the glass funnel is securely attached to the filter holder. Loosen the small top nut on the filter container. Arrows will be present on the filter holder showing air flow direction and they should always point to the end of the sample probe line.
5. Holding the module with the glass funnel facing down, slide the probe into the top fitting of the filter module and tighten the nut. Tighten the nut until the ERG Cr+6 Filter Holder Module is securely fastened to the probe. Do not overtighten the plastic nut.

NOTE: If running a field blank, repeat steps 1 through 5, count to 10, and then remove the field blank filter holder module and place it back into the antistatic bag. Label the bag to designate the filter module as a field blank. Log the filter ID as field blank in the comments section of the ERG Hexavalent Chromium Sample Data Sheet. The field blank must be run before the sample filter module is fastened to the probe.

Sample Recovery and Data Collection

NOTES:

- I. Samples must be retrieved the day following sampling, preferably *NLT NOON LST*, and returned to ERG cold using the ice substitutes provided.
 - II. Gloves must be changed for each sample, i.e. between retrieving a sample and preparing a new run, to prevent cross contamination.
1. On the ERG AMBIENT HEXAVALENT CHROMIUM DATA SHEET, fill in the "Field Recovery" section. Be sure to fill in the "Recovery Date", "Recovery Time", "Elapsed Time" (ETXXXXMin from sampler), and circle a "Status" selection. This information will be on the "MAIN STATUS SCREEN".
 2. Conduct a final flow check (verification) by following the instructions in section C. **Verification**. Record the measurement from the flow standard on the ERG AMBIENT HEXAVALENT CHROMIUM DATA SHEET under the "Field Setup" section, "Final Rotameter Reading".

3. Put on a clean pair of powderfree gloves
4. Take the module storage container from the cooler, open, and set aside.
5. While holding the ERG Cr+6 Filter Holder Module, loosen the top nut holding the module to the sample inlet and slide the module off the stainless steel probe.
6. Place the ERG Cr+6 Filter Holder Module including glass funnel in the plastic bag and place back into the storage container. Place the storage container into a cooler with ice substitutes.
7. Place cover back on end of probe line.
8. Data may be downloaded to a laptop using the PQ100/200 DOWNLOAD SOFTWARE. ERG does not require this data, but direction can be found in the BGI PQ167 Quick Start document, pages 16 and 17.

Sample Shipping

The ERG Cr+6 Filter Holder Module container must be packed in a cooler with ice substitutes and shipped overnight cold to ERG. The sample paperwork must be included in the shipment. Use the pre-filled out FedEx label provided by ERG, and fill out the "Sender" section with the sampling agency's address and phone number. Send priority overnight to ERG.

If the shipping form is lost, use the address below for shipping to ERG, and contact them directly for the FedEx accounting.

Address: ERG
601 Keystone Park Drive
Suite 700
Morrisville, NC 27560
919-468-7924

IV. QUALITY ASSURANCE

To ensure that quality data is being collected the following checks should be considered:

A. Flow Calibration

A flow verification must be completed at the beginning of the study period. If the verification does not compare within 4%, the flow must be calibrated. Document all quality assurance activities in the logbook.

B. Flow Verifications

The flow must be verified or checked at the beginning and end of the sampling event to determine an average sample flow. Document all quality assurance activities and observations in the logbook.


C. Independent Audits

If possible, it is recommended that an independent flow check of the sampler be conducted at some point during the study. This check may be conducted by a state or local agency's quality assurance team or independent audit program.

V. DATA FORMS

All sample related run data forms will be supplied by ERG. Check the data sheets for completion after every setup or retrieval event. The operator is expected to keep a logbook to document all site activities, quality assurance activities, and sampling activities. The ERG AMBIENT HEXAVALENT CHROMIUM DATA SHEET is attached below.

ERG Ambient Hexavalent Chromium Sample Data Sheet

 <div>ERG Lab ID # _____</div>		
AMBIENT HEXAVALENT CHROMIUM DATA SHEET		
Lab Pre-Sampling	Site Code: _____ Collection Date: _____ City/State: _____ Primary Event (Y/N): _____ AQS Code: _____ Collocated Event (Y/N): _____	

	Site Operator: _____ System #: _____ Set-Up Date: _____ Elapsed Timer Reset (Y/N): _____ Collection Date: _____ Batch I.D. No.: _____ Initial Rotameter Setting (C.O. B.): _____ (After 5 minutes warm-up) Programmed Start Time: _____ Programmed End Time: _____	
Field Setup	-----	
	Recovery Date: _____ Recovery Time: _____ Final Rotameter Reading (C.O.B.): _____ (After 5 minutes warm-up) Elapsed Time: _____ Status: Valid Void (Circle one)	

Lab Recovery	Received by: _____ Date: _____ Refrigerator No: _____ Status: Valid Void (Circle one) Temperature: _____ If void, why: _____ Collection Time (Minutes): _____ Flowrate (L/min): _____ Total Volume of Air Sampled (m ³): _____	

Comments: _____

White: Sample Traveler

Canary: Lab Copy

Pink: Field Copy

APPENDIX D
COLLECTION AND ANALYSIS
OF
HEXAVALENT CHROMIUM IN AMBIENT AIR



January 9, 2007

Mr. Michael Jones
Emissions, Monitoring and Analysis Division (C339-02)
Office of Air Quality Planning and Standards
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711

Dear Mr. Jones:

I have enclosed a copy of the paper we recently presented for "Collection and Analysis of Hexavalent Chromium in Ambient Air". We presented this paper at the NEMC in Washington, DC (August, 2006), and the QA Region 6 Conference, in Dallas, TX (October, 2006).

If you have any questions or comments, please call me at (919) 468-7924.

Sincerely,

Julie L. Swift

Julie L. Swift
Senior Program Manager

cc: Dennis Mikel, EPA

Collection and Analysis of Hexavalent Chromium in Ambient Air

Prepared by J. Swift, M. Howell, D. Tedder

Eastern Research Group, 601 Keystone Park Drive, Suite 700, Morrisville, NC 27560

ABSTRACT

Hexavalent chromium (Cr^{6+}) is one of the top four pollutants of concern in the EPA National Air Toxics Trends Stations (NATTS) Program. The Environmental Protection Agency (EPA) worked in conjunction with Eastern Research Group (ERG) to improve the California Air Resource Board (CARB) Method 039 for Cr^{6+} monitoring. Attempts to sample and analyze Cr^{6+} at NATTS with improved sensitivity uncovered challenges in the sampling procedures. Issues with background contamination on filters and stability of field samples were the most important contributors to bias and imprecision. Different filters and filter preparations were studied to minimize background Cr^{6+} on filters. A standardized method for media preparation and storage will be discussed. A stability study was performed to determine the best storage conditions to maintain Cr^{6+} stability with less than 30 Relative Percent Difference (RPD). The stability of Cr^{6+} was also evaluated using collocated samplers with spiked and blank filters. Data, using improvements to the Cr^{6+} sampling and analysis procedure for the NATTS, will be presented to show the recent history of Cr^{6+} recovery from field samples.

INTRODUCTION

Chromium is a natural constituent of the earth's crust and is present in several oxidation states. Trivalent chromium (Cr^{3+}) is naturally occurring, environmentally pervasive and a trace element in man and animals. Hexavalent chromium is anthropogenic from a number of commercial and industrial sources. It readily penetrates biological membranes and has been identified as an industrial toxic and cancer substance. Hexavalent chromium is a known inhalation irritant and associated with respiratory cancer. Exposure occurs primarily in the chrome plating and anodizing process, and emissions from chromate treated cooling towers.

METHOD DEVELOPMENT

Previous sampling and analysis studies for Cr^{6+} at NATTS have shown a variety of issues including filter contamination and storage stability issues. High filter background concentrations are due to manufacturing processes or contamination in storage. Background contamination results in small differences between measured and blank values, which make data interpretation at low concentrations less confident.

Determining the Sampling Media

Four types of filter media were examined to determine which performed best in terms of background contamination and stability. These filters were prepared using the CARB Standard

Operating Procedure (SOP) 039 to determine if the chromium leaching off the filters at ambient temperatures would cause contamination. The filters used in this study were:

- Cellulose;
- Binderless Quartz;
- Teflon®; and
- Polyvinyl Chloride (PVC).

The results of this study show that the best media is the cellulose filters. The Teflon® filter results are questionable because the coating solution does not adhere to these filters. The results for all of the filters are presented in Table 1 below.

Table 1: Chromium Filter Background Contamination – Assessing the Filter Media

Sample Name	Filter Media Concentrations (total ng)			
	Cellulose	Binderless Quartz	PVC	Teflon®
Day 0 – 1	Not Detected	8.42	2.43	0.320
Day 0 – 2	Not Detected	6.95	2.03	0.370
Day 0 – 3	Not Detected	8.22	3.00	0.400
Day 6 – 1	Not Available	21.9	Not Available	Not Available
Day 6 – 2	Not Available	47.7	Not Available	Not Available
Day 6 – 3	Not Available	28.3	Not Available	Not Available
Day 12 – 1	1.44	Not needed	15.9	0.430
Day 12 – 2	1.12	Not needed	14.6	ND
Day 12 – 3	0.760	Not needed	14.4	ND

ERG treated the cellulose filters selected from initial evaluation of filter media in an attempt to reduce the background below the detection limit of the analysis method. Filters were cleaned with nitric acid to remove hexavalent chromium prior to filter preparation before sampling. Once cleaned, hexavalent chromium was not detected on any unspiked filters. Recovery on spiked filters was from 92 to 100 percent. Based on these results, the acid washed filters are determined to have no associated chromium contamination.

Temporal Stability Study

A temporal study was performed on cellulose and Teflon filters because of the low recovery of background Cr^{6+} in the background contamination study. To determine if the preferred filter preparation method would interfere with recovery of Cr^{6+} samples, 32 bicarbonate coated cellulose and 32 Teflon filters were prepared and spiked. All filters were spiked with 2.5 total ng Cr^{6+} and placed on the laboratory countertop. The experimental design for each filter media included:

- Four spiked filters were analyzed the day they were spiked and four were placed in the freezer.
- Four spiked filters were analyzed the day after spiking (Day 2) and four were placed in the freezer.
- Four spiked filters were analyzed two days after spiking (Day 3) and four were placed in the freezer.
- Four spiked filters were analyzed three days after spiking (Day 4) and four were placed in the freezer.

Table 2 shows the spiked filter results.

Table 2: Cr⁶⁺ Filter Stability Study

Spiked Samples	Cellulose Filters		Teflon Filters	
	Average Concentration (total ng)	Percent Recovery	Average Concentration (total ng)	Percent Recovery
Stored at Room Temperature				
Day 1	2.17	87 ± 3%	2.05	89 ± 5%
Day 2	2.20	88 ± 4%	2.25	98 ± 6%
Day 3	2.28	91 ± 3%	2.27	99 ± 35%
Day 4	1.93	77 ± 10%	2.53	110 ± 3%
Stored at -18°C				
Day 1	2.62	105 ± 3%	NA	NA
Day 2	2.66	107 ± 3%	NA	NA
Day 3	2.74	109 ± 7%	2.46	108 ± 8%
Day 4	2.58	103 ± 7%	NA	NA
Day 7	2.75	110 ± 8%	NA	NA
Day 8	2.54	102 ± 4%	NA	NA
Day 9	2.57	103 ± 1%	NA	NA
Day 10	2.60	104 ± 4%	NA	NA
Day 11	2.71	108 ± 2%	NA	NA
Blanks	ND	NA	ND	NA

NOTE: Results listed in **bold** are outside the required relative percent difference (RPD) of 25%.

One of the purposes of this study is to determine whether it is feasible to have the filters stored in the field for more than one day after sampling. The cellulose filters stored at room temperature had a reduced recovery from 87 percent on Day 1 to 77 percent on Day 4. The recoveries for the Teflon filters stored at room temperature varied from Day 1 to Day 4 by approximately 15 percent. Once the cellulose filters were stored at -18°C before analysis, however, the percent recovery varied 102 to 110 percent. Because only one set of Teflon filters was frozen for the stability study, limited data is available for conclusions; however, the recovery for Day 3 is 108 percent. This study shows that the cellulose filters would need to be recovered within 1 day to determine the best recovery, whereas the Teflon filter could be recovered up to 4 days without

any significant loss. Also, once frozen, the Cr^{6+} can be considered stable and can be left on the cellulose filters for up to 11 days.

Interfering Element Check

Possible interfering compounds were added to the filters and to determine if there were any positive or negative interference when analyzing for Cr^{6+} . All filters were spiked with 10 total ng of Cr^{6+} . Four separate sets of filters were spiked with 10 total ng of Cr^{3+} , Fe, and Mg. All recoveries were within $95\% \pm 13\%$, indicating that these elements do not pose any interference for the analysis of Cr^{6+} .

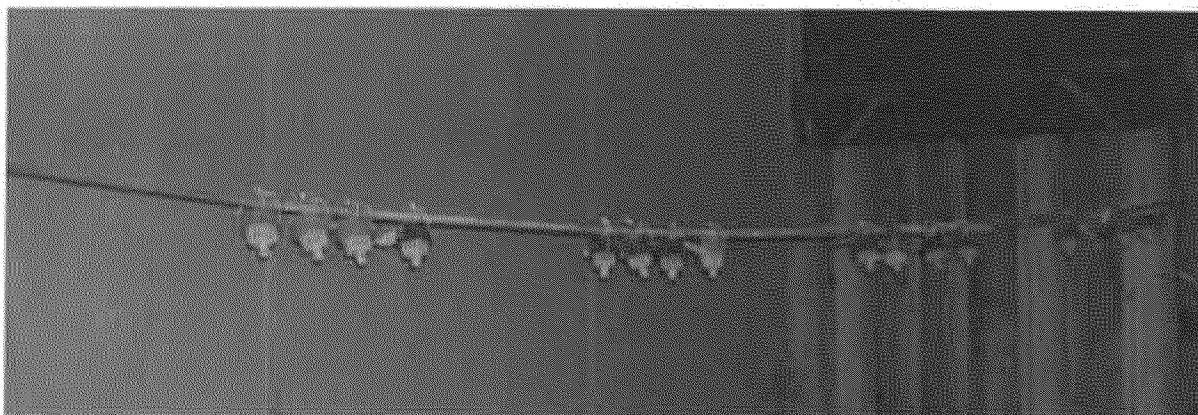
Method Validation

Field studies were performed to validate the filter preparation and storage study determined acceptable under laboratory conditions.

Cr⁶⁺ Sample Stability Study

In order to determine the stability of a sample in field before retrieval, filters were spiked and left in the field for up to 4 days. All filters were spiked with 2.5 total ng Cr^{6+} . Filters were installed on a line in the field. Four filters were prepared for each batch of samples and are shown in Figure 1.

Figure 1. Field Cr^{6+} Sample Stability Study



The filters were left for 33 hours – 24 hours (based on 1 day) plus 9 hours (needed for sample retrieval). All samples were analyzed on the day the samples were recovered, as presented in Table 3.

Table 3: Cr⁶⁺ Filter Stability Study – Sample Stability (Cellulose Filters)

Spiked Samples in Field	Average Concentration (total ng)	Percent Recovery	Average Relative Percent Difference (RPD)	Coefficient of Variation (CV)
Spiked and placed in Freezer after Days presented and analyzed after sample pickup.				
33 Hours	1.76	70%	30% ± 6%	8%
57 Hours	1.27	51%	49% ± 6%	13%
81 Hours	1.19	48%	53% ± 4%	9%
105 Hours	1.05	42%	58% ± 5%	11%

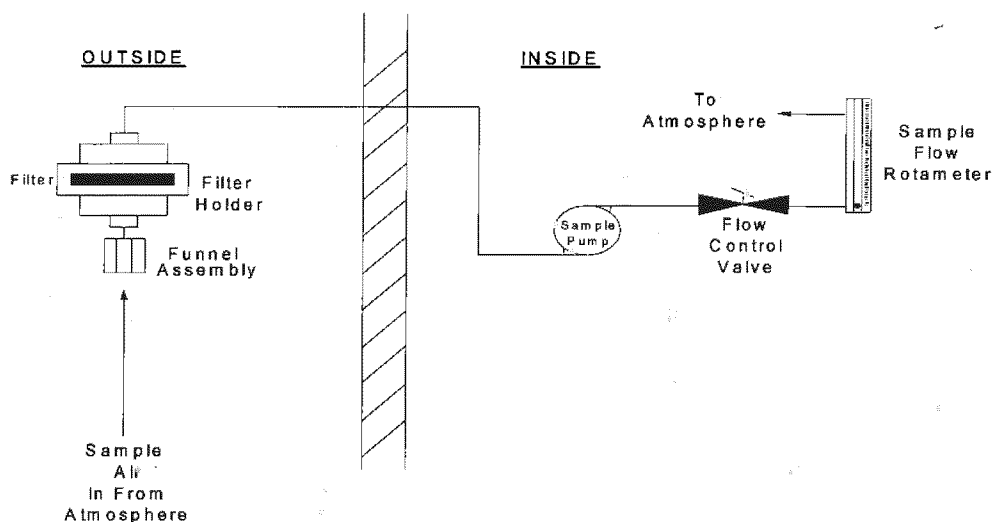
NOTE: Results listed in **bold** are outside the required relative percent difference (RPD) of 25%.

The purpose of this study was to determine whether it is practical to leave the cellulose filters in the field for more than one day after sampling. The cellulose filters stored in the field had reduced recoveries from 70 percent for 33 hours (24 hours + 9 hours for recovery) to 42 percent for 105 hours (24 hours times 4 days + 9 hours for recovery). This study shows that the cellulose filters would need to be recovered within 1 day in order to allow the best recovery possible. Once frozen, however, the Cr⁶⁺ can be considered stable and can be left on the cellulose filters for up to 11 days (as presented in Table 2).

Cr⁶⁺ Sampling Study

To continue evaluating the preparation and stability of these filters, a field sampling study was performed. A hexavalent chromium sample is collected by pulling ambient air through the prepared filter at a known flow rate for a period of 24 hours. The hexavalent chromium sampling system is designed to automatically perform a 24-hour filter collection and is automated using a digital timer to initiate sample collection at a flow rate of 15 Lpm. The prepared filter assembly is attached to the inlet of the probe, and the funnel is attached to the inlet of the filter assembly. At the end of the 24-hour collection period, the filter assembly containing the exposed filter is removed from the sampler. The Teflon rod stock plugs are reinserted into the inlet and outlet. Figure 1 presents a standard Cr⁶⁺ sampling layout.

Figure 1. Cr⁶⁺ Sampler Layout



Cr⁶⁺ Sampling Study – Cellulose Filters

A sampling site was chosen for the initial study which included a collocated sampler loaded with either spiked or unspiked filters. For the initial study, each sample sets collected the following cellulose filters:

- One filter unspiked. (Background Sample)
- One filter spiked at 2.5 total ng. Total spiked amount in a 21.6 m³ sample is 0.12 ng/m³. This value is 10 times the current detection limit, but is assumed an appropriate average result from samples collected in the field. (Spike)
- One trip blank (stored in cooler during sampling period). (Trip Blank)
- One filter spiked at 2.5 total ng and left in the filter container. This filter was stored in the freezer while the samples were taken to the field. It was taken out of the freezer immediately before analysis. (Matrix Spike)

All samples were analyzed the day after collection. The results are presented in Table 4 below. All passive and trip blank samples had no detectable hexavalent chromium. The recoveries of spiked samples are slightly better during cold, wet days.

Table 4: Ambient Monitoring Study – Cellulose Filters

Sample Set	Conditions				RPD	% Recovery
	Sample Volume (m ³)	Humidity	Temperature	Comments		
1	21.57	88%	48.8°F	Rain	28	72%
MS – 1		(58% - 96%)	(44.1°F - 57.9°F)		3.2	103%
2	21.66	81%	41.3°F	Rain	6.4	94%
MS – 2		(38% - 100%)	(37°F - 59°F)		4.0	96%
3	21.7	76%	37.8°F	Overcast to Clear	73	27%
MS – 3		(37% - 100%)	(34°F - 42.1°F)		9.1	109%
4	21.7	42%	35.3°F	Cloudy to Clear	58	42%
MS - 4		(24% - 61%)	(27°F - 45°F)		0	100%

NOTE: Results listed in **bold** are outside the required relative percent difference (RPD) of 25%.
MS = Matrix Spike

The cellulose filters showed varying recoveries on the samples taken. Two of the 8 spiked filters recovered under 70%, with a total average recovery at 80%.

Cr⁶⁺ Sampling Study – Teflon® Filters

A comparison study was performed to reproduce the sampling completed on the cellulose filters. This study is presented in Table 5 and is described below:

- Teflon Set 1 through 3 followed same procedures as the cellulose study (spiked at 2.5 total ng),
- Teflon Set 4 through 7 collected using a lower flow rate at 8 L/min (spiked at 2.5 total ng for 4 and 5, 5.0 total ng for 6 and 7),
- Teflon Set 8 and 9 collected at 15 L/min with a particulate filter before the spiked filter (spiked at 2.5 and 5.0 total ng, respectively),
- Teflon Set 10 and 11 collected using an ozone scrubber cartridge (used for TO-11A sampling) that would take out ozone as well as particulate (spiked at 2.5 total ng).

Table 5: Spiked Teflon Filter Study (with rough polypropylene support)

Sample Set	Setup	RPD	% Recovery
Teflon Set 1	Standard conditions at 15 L/min	24	76%
Teflon Set 2		64	36%
Teflon Set 3		4.0	96%

Sample Set	Setup	RPD	% Recovery
Teflon Set 4	Flow at 8 L/min	1.2	101%
Teflon Set 5		83	17%
Teflon Set 6		9.0	109%
Teflon Set 7		60	41%
Teflon Set 8	Collected a particulate filter before spiked filter	1.9	98%
Teflon Set 9		5.6	94%
Teflon Set 10	Collected using an ozone scrubber before spiked filter	13	113%
Teflon Set 11		6.3	94%

NOTE: Results listed in **bold** are outside the required relative percent difference (RPD) of 25%.

The Teflon also showed varying recoveries. Three of the 11 spiked filters recovered under 70%, with a total averaged recovery at 80%. This indicated a close comparison of the Teflon to the cellulose filter Cr^{6+} collection.

Cr^{6+} Sampling Study – Interferants

In order to distinguish other possible interferants, another set of experiments were preformed:

- Volume Check - the rate of collection was too high by reducing the overall sample volume to 11.5 m³,
- Particulate Check - the particulate reacted with the Cr^{6+} to reduce it to Cr^{3+} by having a Teflon filter inline before the spiked filter, and
- Ozone Check – ozone reacts to oxidize other agents that could reduce the Cr^{6+} to Cr^{3+} .

As presented in Table 6, the Cr^{6+} recovery was not affected by changing any of these parameters (volume, particulate and ozone).

Table 6: Physical interferants check for Cr^{6+} sampling.

Sample	Spiked in total ng	Results in total ng	Percent Recovery
Volume Check – collected at 11.5 m ³ (instead of standard 21.6 m ³)			
Run 1	2.5	2.53	101%
Run 2	5.0	5.45	109%
Particulate Check – collected particulate before ambient air crossed spiked filter			
Run 1	2.5	2.45	98%
Run 2	5.0	4.72	94%
Ozone Check – scrubbed ozone and particulate before ambient air crossed spiked filter			
Run 1	2.5	2.82	113%
Run 2	5.0	4.68	94%

Comparison Sampling using Cellulose and Teflon Filters

The optimal way to confirm the performance using either filter is to collect collocated sets of cellulose and Teflon filters. ERG sent five different NATTS sites the standard cellulose and Teflon filters as a means to evaluate the performance of the Teflon filters. These sites were selected based on recent history of Cr^{6+} in their samples. The results are presented in Table 7 below.

Table 7: Comparison of Cr^{6+} Recovery on Cellulose and Teflon Filters

Site	Total # of Samples	Cellulose Concentration Higher (>30% RPD)	Similar Results on Cellulose and Teflon ($\pm 30\%$ RPD)	Teflon Concentration Higher (>30% RPD)
Boston, MA	3	100%	0%	0%
Detroit, MI	5	80%	20%	0%
Seattle, WA	4	25%	75%	0%
Tampa, FL	5	80%	0%	20%
Washington, DC	4	75%	0%	25%
Average	4	72%	19%	9%

Note: Sampling was conducted from June to August 2005.

This table shows the total number of samples collected at each site and compares the Cr^{6+} recoveries of the cellulose to the Teflon filters. For example, the site in Detroit sampled 5 sets of collocated filters (one cellulose and one Teflon filter) during the same sampling period. One of these filter sets had similar recoveries on the cellulose and Teflon filters, and the other 4 filter sets had higher Cr^{6+} recoveries on the cellulose filters. The lower recovery on the Teflon filters could be due to other reducing agents in the ambient air that would convert the Cr^{6+} to Cr^{3+} . This is prevented on the cellulose filters because of the sodium bicarbonate coating. In Seattle, WA, the air stream is blown from the west, off the Pacific Ocean. Because of the lower interference from mobile and emission sources, the difference between the cellulose and Teflon filters is minimal. The other 4 sites (Boston, Detroit, Tampa, and Washington, DC) are in highly populated areas where these emissions could reduce the Cr^{6+} significantly. Based on the results of this sampling study, ERG determined that collection on the acid washed, sodium bicarbonate coated cellulose filters would recover the Cr^{6+} more efficiently for real-world ambient samples.

FIELD SAMPLE RESULTS FOR HEXAVALENT CHROMIUM

Twenty-two National Monitoring Program (NMP) sites collected Cr^{6+} samples from January 2005 to December 2005. Some monitors were placed near the centers of heavily populated cities (e.g., Chicago, IL and Detroit, MI), while others were placed in moderately populated areas (e.g., Madison, WI and Hazard, KY). Hexavalent Chromium concentrations measured during this time varied significantly from monitoring location to monitoring location. The proximity of the monitoring locations to different emissions sources, especially industrial facilities and heavily traveled roadways, often explains the observed spatial variations in ambient air quality.

Table 8 presents the frequency of detects, maximum value, minimum detected value, median, and average.

Table 8: Analytical Results for samples collected between January 2005 and December 2005.

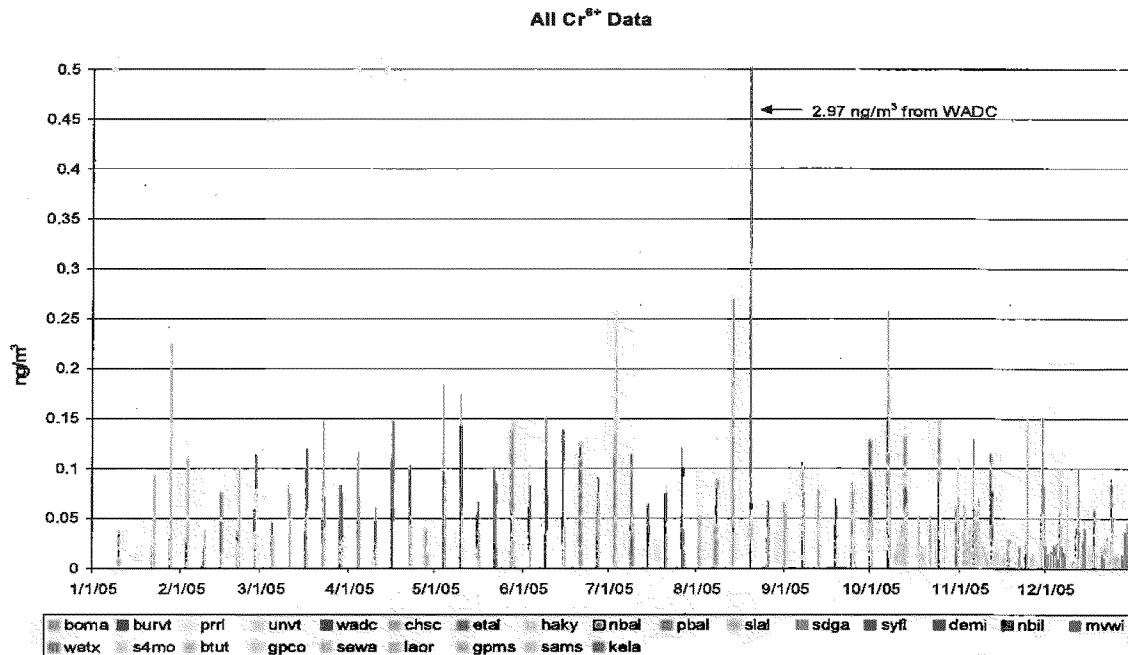
Sites	% Frequency	Maximum Value (ng/m ³)	Minimum Value (ng/m ³)	Median (ng/m ³)	Average (ng/m ³)
Roxbury, MA	78%	0.269	0.017	0.048	0.071
Burlington, VA	80%	0.147	0.003	0.054	0.065
Providence, RI	100%	0.119	0.006	0.023	0.028
Underhill, VT	32%	0.101	0.005	0.027	0.034
Washington, DC	54%	2.970	0.010	0.026	0.156
Chesterfield, SC	40%	0.147	0.006	0.024	0.034
Birmingham, AL (site 1)	73%	0.081	0.020	0.041	0.049
Hazard, KY	43%	0.103	0.011	0.029	0.036
North Birmingham, AL	67%	0.100	0.016	0.046	0.050
Providence, AL	50%	0.026	0.004	0.019	0.016
Birmingham, AL (site 2)	56%	0.104	0.029	0.044	0.052
S. Dekalb Co., GA	100%	0.116	0.010	0.039	0.039
Tampa, FL	56%	0.134	0.007	0.032	0.042
Detroit, MI	85%	0.146	0.006	0.066	0.066
Chicago, IL	67%	0.112	0.006	0.031	0.036
Madison, WI	48%	0.132	0.008	0.022	0.032
Austin, TX	85%	0.100	0.016	0.035	0.040
St. Louis, MO	71%	0.109	0.015	0.036	0.041
Bountiful, UT	100%	0.079	0.004	0.027	0.030
Grand Junction, CO	68%	0.095	0.002	0.027	0.030
Seattle, WA	86%	0.224	0.010	0.042	0.053
La Grande, OR	100%	0.256	0.005	0.017	0.034
Kenner, LA	55%	0.040	0.001	0.022	0.021
Gulf Port, MS	65%	0.083	0.003	0.020	0.025
Stennis Airport, MS	33%	0.034	0.002	0.014	0.015
Average	67%	2.970	0.001	0.032	0.044

A total of 1,466 Cr⁶⁺ measurements were detected at the 22 NMP sites from January 2005 to December 2005. Two hundred and thirty of these were taken at three sites during the clean up after Hurricane Katrina. Of the 1,466 Cr⁶⁺ measurements, 67% of these results were detects and 9% of these concentrations were below the MDL. The average Cr⁶⁺ concentration was 0.044 ng/m³.

Data from the NMP sites is presented in Figure 2. The highest concentration was taken at

Washington, DC, at 2.97 ng/m³. The samples taken for Katrina were collected on a 1-in-1 schedule starting October 10, 2005. Hexavalent chromium results at Katrina monitoring sites were similar or slightly lower than other sites in the program.

Figure 2: Analytical Cr⁶⁺ Results for samples collected between January 2005 and December 2005.



DATA QUALITY CONTROL AND ASSURANCE

Precision of the analytical and sampling technique was determined using the analysis of collocated sampling episodes. A collocated sample (i.e., a sample collected simultaneously with the primary and collocated sample using separate sampling systems) provides information on the potential for sampling variability. ERG was not able to perform replicate analyses because the final sample instrument injection volume did not allow the replicate analyses. Method spikes were analyzed, however, and give an acceptable range of 80-120% recovery. The collocated results were compiled from sites sampling in the NMP from January 2005 through December 2005.

The collocated data is presented in Relative Percent Difference (RPD). The RPD expresses average concentration differences relative to the average concentrations detected during collocated analyses. The RPD is calculated as follows:

$$RPD = \frac{|X_1 - X_2|}{\bar{X}} \times 100$$

Where:

X_1 is the ambient air concentration of a given compound measured in one sample;
 X_2 is the concentration of the same compound measured during collocated analysis; and
 \bar{X} is the arithmetic mean of X_1 and X_2 .

As this equation shows analyses with low variability have lower RPDs (and better precision), and analyses with high variability have higher RPDs (and poorer precision). The RPD method quality objective for all data from the NMP is 25 percent. The overall data average RPD result for 2005 was 17%, which is within the 25% target. Table 9 presents the collocated data results.

Table 9: Collocate Statistical Data Results (January 2005 to December 2005).

Site ID	# of Collocates	Median (RPD)	Average (RPD)	Percent Standard Deviation
Roxbury, MA	6	10%	14%	12%
Burlington, VA	11	6%	18%	35%
Providence, RI	6	21%	35%	47%
Underhill, VT	6	0%	5%	6%
Washington, DC	4	1%	9%	16%
Chesterfield, SC	6	0%	12%	0%
Hazard, KY	5	0%	6%	0%
North Birmingham, AL	1	0%	0%	0%
Providence, AL	1	0%	0%	0%
Birmingham, AL (site 2)	1	0%	0%	0%
S. Dekalb Co., GA	2	41%	41%	0%
Tampa, FL	5	0%	18%	29%
Detroit, MI	5	16%	14%	13%
Chicago, IL	3	18%	14%	12%
Madison, WI	4	16%	16%	17%
Austin, TX	1	33%	33%	0%
St. Louis, MO	4	4%	8%	11%
Grand Junction, CO	5	0%	10%	22%
Seattle, WA	6	10%	32%	55%
Gulf Port, MS	7	27%	27%	25%
Stennis Airport, MS	1	19%	19%	0%
Kenner, LA	4	17%	35%	43%
Average	4	8%	17%	16%

CONCLUSIONS

Based on the results of this study, ERG concludes Teflon filters do not collect the Cr^{6+} more efficiently than cellulose. Reducing agents in the ambient air seem to be converting the Cr^{6+} to Cr^{3+} and the filter media must stabilize and protect the Cr^{6+} from these reducing agents. The Teflon filters do not have the buffer coating (sodium bicarbonate) to stabilize the Cr^{6+} on the filter when reducing agents are present (such as acid gases).

ERG laboratory's detection limit for acrolein is 0.012 ng/m^3 (experimentally determined using 40 CFR, Part 136 procedures) which is lower than the cancer and noncancer health risk threshold concentration. Based on the results of this study, sample collection using the sodium bicarbonate coated cellulose filters is recommended. There are certain preservation procedures that must be followed before acceptable sample results should be reported, including:

- The filters must be acid washed and rinsed before coating them with the sodium bicarbonate to prevent Cr^{6+} background. Using this method however, does not lengthen the collection or storage hold time.
- All samples must be retrieved from the field one day after the sample has been collected to prevent Cr^{6+} negative bias (loss) (up to 20% on the first day).
- All samples must be frozen after collection to reduce the risk of Cr^{6+} loss.

Analysis of sodium bicarbonate coated cellulose filters containing known concentrations of Cr^{6+} demonstrated acceptable recoveries, if the samples are recovered as soon as possible after sampling ends.

ERG has determined that this modified method shows consistent recovery for Cr^{6+} over time throughout the country. The collocated sample recoveries meet the method quality objectives set by the EPA for the NATTS program, however there does seem to be limitations on sample recovery for loading filters outside of the controlled laboratory conditions.

ACKNOWLEDGMENTS

The authors would like to express their appreciation for the hard work and dedication shown by the U.S. EPA, OAQPS staff and Eastern Research Group's laboratory.

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Appendix E

**Region 7 Standard Operating Procedure No. 2314.06A,
"Measurement of Hexavalent Chromium Using the BGI PQ167R
Low Volume Sampler,"
(U. S. EPA, 2011)**

STANDARD OPERATING PROCEDURE

NO. 2314.06A

Measurement of Hexavalent Chromium Using the BGI PQ167R Low Volume Sampler

November 7, 2011

Leland P. Grooms
ENSV/CARB/ASRS

Approved

Peer Reviewer

Date

Chemical Analysis and Response Branch Manager

Date

Independent Quality Assurance Reviewer

Date

10/10/19

10/10/19

10/10/19

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Attachments

None

A. Purpose

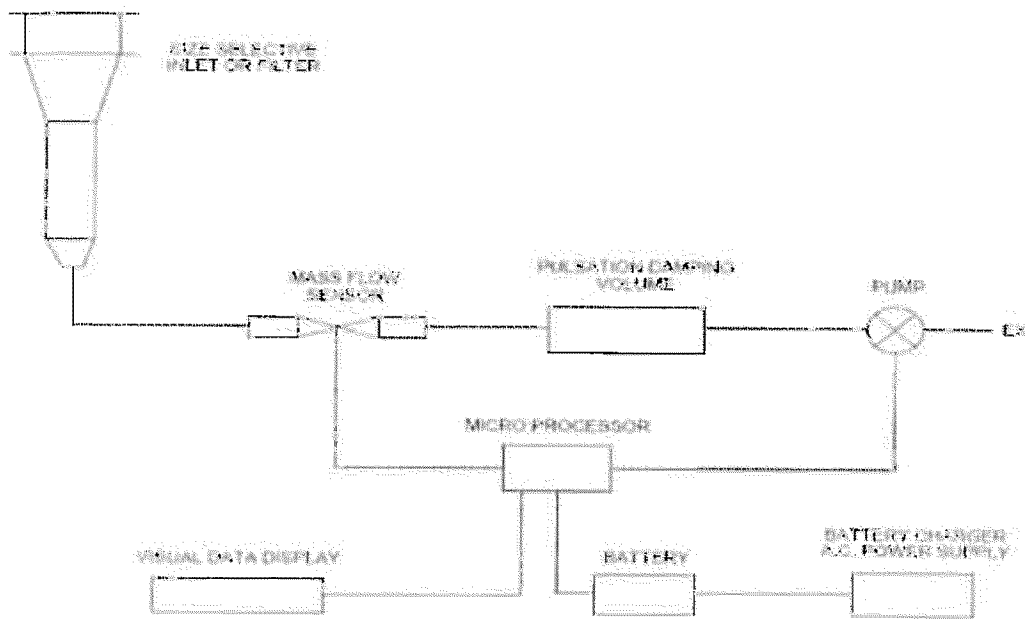
This procedure is designed to provide instruction on collecting hexavalent chromium (Cr+6) in air using the BGI PQ167R ambient air sampler for metals analysis. These procedures are not intended to replace the manufacturer's operations or technical manuals. This SOP is designed to be a step by step method for operating the sampler to be used in conjunction with the manufacturer's operator's manual. Maintenance and troubleshooting should be conducted using the BGI167R operator's manual.

B. Applicability

This SOP is intended to be used during the 2011-2012 CertainTeed ambient air sampling project.

C. Summary of Procedure

The operating principle of the BGI PQ167R can be appreciated by referring to the block diagram in Figure 1 below. The BGI PQ167R is an "Intelligent Air Pump" that can monitor its own airflow rate and thereby adjust the pump speed to compensate for changes in load pressure and/or other forces which would otherwise hamper the flow of air through a filter (or sample collector). The PQ100 unit can be programmed to begin its sampling job at a specific date, time, and stop sampling after the user defined run time is depleted. Air is drawn by the pump through a size selective inlet device and/or filter. It then passes inside the instrument housing to a Mass Flow Sensor. The signal generated by the sensor is then routed to a microprocessor which determines if the flow is at the set value and adjusts the pump speed to maintain the correct flow rate. Because the flow sensor is extremely sensitive and all pumps produce pulsation to some degree, a pulsation damping volume has been introduced to control this effect. The microprocessor not only controls the flow rate accurately and precisely to the set point but also performs several other functions. These include turning the instrument on at a preselected time and running it for a selected interval. The flow is maintained by the processor to a designated pressure and temperature value. A pulse width modulated signal is configured and sent to the pump motor in a constantly updated manner based on signal information received from the Mass Flow Sensor. The microprocessor also stores all parametric information generated during the run period and configures it for presentation on the visual display and downloading to the software provided with the instrument. The system is completed by its 12 volt battery and external battery charger/A.C. power supply. The power supply function permits operation if desired with no battery whatsoever.



(Figure 1)

D. Definitions/Acronyms

1. ERG: Eastern Research Group
2. SOP: Standard Operating Procedure

E. Personnel Qualifications

Only persons familiar with procedures described in the SOP should use the BGI PQ167R.

F. Health and Safety Warnings

1. The BGI PQ167R instrument is not intrinsically safe and should not be used in explosive environments.
2. Whenever the BGI PQ167R is to be installed at a height greater than 3 meters it must be securely bolted in place or anchored in some way.

G. Cautions

Siting instructions should be followed carefully in order to obtain useful data. When determining appropriate sites to place this instrument, both project objectives (how will the data be used and what information is needed?) and site conditions (where are obstructions relative to the monitor?) need to be considered.

H. Interference

The instrument's electronic and mechanical parts should be protected against heavy rain, snow and inclement weather.

I. Equipment and Supplies

1. BGI PQ167R
2. ERG Cr+6 filter holder apparatus
3. Flow calibrator
4. Logbook
5. ERG filter assembly with glass funnel
6. Cooler with ice substitute
7. Powder-free gloves
8. Sample processing paperwork

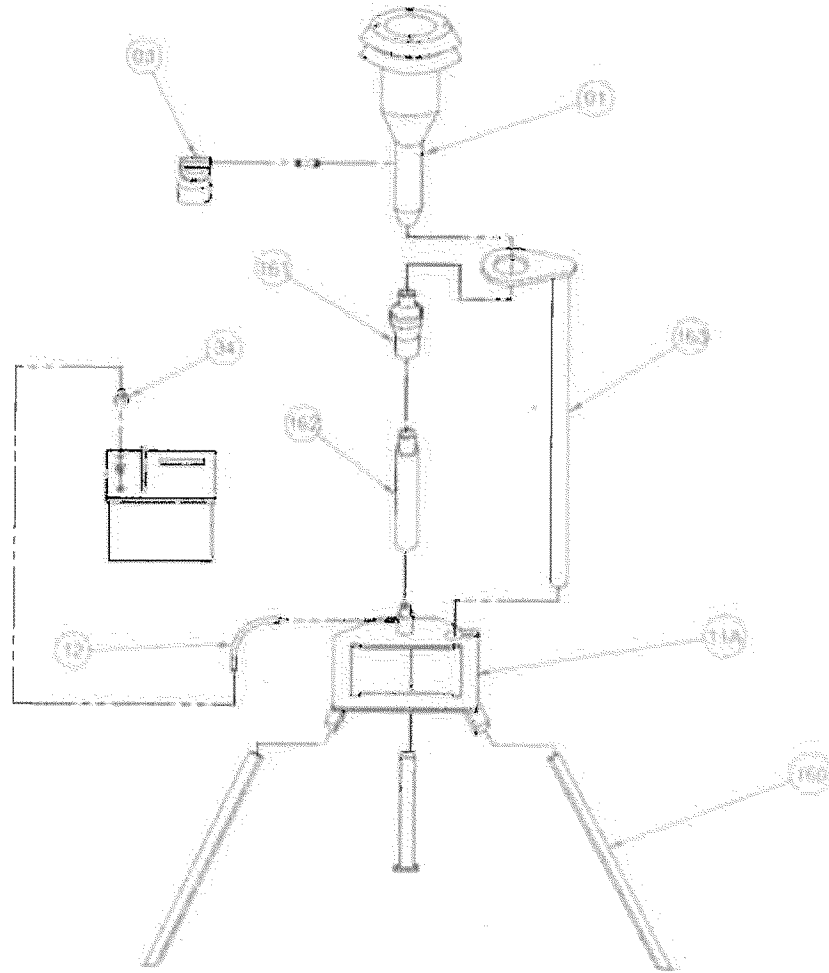
J. Procedures

1. **Siting the Monitor** – The optimal site for ambient air monitoring is in a location where the BGI PQ167R instrument is near the breathing zone. If the BGI PQ167R is placed on a roof or other structure there must be a minimum of 2 meters of separation from walls, parapets, penthouses, etc. If the BGI PQ167R is placed near trees it should be placed at least 20 meters from the drip line of the tree. In general, the BGI PQ167R must be located in an area free from obstructions. The distance between obstructions and the sampler must be at least twice the height of the obstruction. If possible, the BGI PQ167R should not be placed near busy roads (more than 3,000 vehicles per day), if placing the BGI PQ167R near a lower traffic road is unavoidable then it should be placed at least 5 meters from the edge of the nearest traffic lane.
2. **Setup**
 - a. Assemble the sampler according to Figure 2 below omitting the installation of the PM10 inlet head, filter cassette holder assembly, and downtube assembly brace. For detail and illustration, refer to the BGI PQ167 Quick Start document, pages 2 through 8.
 - b. Place and level the sampler on site. To secure the sampler and protect membrane roofs, 2 x 4 wooden studs may be cut into one foot sections and fastened to the feet of the legs using lag bolts. Place sand bags on these skids to prevent tipping of the sampler.
 - c. Connect the sampler to a grounded electrical outlet with 115 volts, and at least 5 amp service. Protect the connector from precipitation by fastening beneath the sampler or wrapping it with plastic tape.

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(Figure 2)

- d. If operating using a deep cycle marine battery for power, install the external power cord by screwing the round harness into the “utility adapter” port on top of the sampler. Attach the positive and negative contacts to the deep cycle marine battery and secure. A fully charged battery should provide power for at least 2 sampling runs. Depending on the battery available, more consecutive runs may be possible. Store the battery in a plastic container near the sampler to conceal and protect it from the weather.
- e. If collocated samplers will be located at the site, the two samplers must be within four (4) meters of each other, but outside of two (2) meters. The inlet heights must be within one (1) meter vertically.
- f. The sampling unit, at this point, should have legs mounted on the stand, and the pump and power components should be secured in the stand

according to the PQ167 Quick Start document. The downtube, PM10 inlet head, and filter cassette holder assembly should NOT be installed.

- g. Install the downtube on the top of the cylindrical mount on the stand. The mount should have tubing leading from the port on its side to the inlet on the pump module.
- h. The total ERG Cr+6 filter holder apparatus consists of a BGI flow adapter with shut-off valve, stainless steel connector fitting, a length of "U" shaped stainless steel ¼ inch tubing, ERG filter assembly, and a glass funnel. The filter assembly and glass funnel will be provided for each sampling run and should not be installed until a sampling run is setup. Place this apparatus (without ERG filter assembly) on the top of the downtube, and ensure that the shut-off valve is in the open position.
- i. The open end of the stainless steel tubing should be capped when sampling is not in progress to prevent contamination.

3. Operation

- a. Plug sampler into AC power and charge the internal battery for at least 24 hours.
- b. Check parts and components against the packing list.
- c. After charging, ensure sampler will power up and that the main screen is operational
- d. The sampler may arrive with a default flow rate of 16.7 Lpm. If during the initial verification, the sampler's target flow rate is displayed as 16.7 Lpm, it must be changed to 15 Lpm. Proceed directly to the calibration section of the SOP for direction in making the change.
- e. The ERG Cr+6 Filter Holder Modules will arrive to the field office in a cooler with frozen ice substitutes. The modules will have paperwork designating them for a specific site and run day. The modules must be kept in a freezer prior to sampling. During transport to the monitoring site for run preparation, the filters must be kept cold as well. Samples must be returned to ERG cold using ice substitutes.

- 4. Verification (Note: The PQ167 does not require a leak test. Cutting off the flow of air by covering or restricting the air flow to the inlet will cause damage to the internal pump and will void the warranty).

- a. Install a test ERG Cr+6 filter holder module if available. If a test module is not available, the module to be used for the next sample day is acceptable; however, the module must be used immediately following the verification/calibration.
- b. Attach a NIST traceable flow standard to the inlet of the filter module. Ensure the flow standard is on and has equilibrated to ambient conditions.
- c. Turn on the PQ167R by pushing the "ON/OFF" button. If a message is blinking on the display, press "ENTER" to proceed to the "MAIN IDLE DISPLAY".

The screen display should read:

ET0000Min TS00.00M (Date)

Q(Flow)Lpm T(Time) Bty(Capacity)%

(Date) – today's date in military notation; e.g., 01JAN= January 1st

(Flow) - the current flow rate selected to be regulated.

(Time) - military time; e.g., 13:08= 13 Hours 8 Minutes or 1:08 PM

(Capacity) - remaining charge in the internal battery.

- d. Press SETUP three times until the Set START DATE and TIME screen appears: The screen should appear as below:

Set START DATE and TIME

(Date) (Time) Off

- e. The word, "Off", should be displayed in the lower right corner of the screen. The bottom line of the display should be flashing. If "On" is displayed, press the "ENTER" button until "On" stops flashing. Then toggle to "Off" by pressing the + or – buttons.
- f. Press the "SETUP" button twice to get to the "MAIN IDLE DISPLAY"
- g. Press the "RUN/STOP" button to activate the pump.
- h. Allow the pump to stabilize for at least 2 minutes.
- i. If the measured flow and the flow indicated on the flow standard are within 4%, the sampler's calibration is acceptable. If the flow is outside 4%, the unit must be recalibrated.

- j. Press the "RUN/STOP" button to turn off the pump.

5. Calibration (Note: The PQ167 does not require a leak test. Cutting off the flow of air by covering or restricting the air flow to the inlet will cause damage to the internal pump and will void the warranty).

- a. Install a test ERG Cr+6 filter holder module if available. If a test module is not available, the module to be used for the next sample day is acceptable; however, the module must be used immediately following the verification/calibration.
- b. Press "SETUP". The screen will read; "Select FLOW RATE"
- c. From the "MAIN IDLE DISPLAY" press the "Setup" key once until the message below appears;

Select FLOW RATE

The Target Q should read 15.0 Lpm. If it does not read 15.0 Lpm, set TARGET FLOW RATE to 15.0 Lpm by pressing ENTER.

The whole number value will remain on constant while the tenths still blink); use "+" or "-" to increase or decrease until 15 is displayed.

Press ENTER (Tenths value will now remain constant while whole number blinks); use "+" or "-" to increase or decrease until .0 is displayed.

- d. From the "Select FLOW RATE" message screen, press both the "Reset" key and the "Run/Stop" key simultaneously to enter the calibration mode and the message below will appear;

CALIBRATE Target=15.0 Lpm

- e. Press the "RUN/STOP" button to activate the pump and the message below will appear:

CALIBRATE Target = 15.0 Lpm

Reference Q.. XX.X

The Reference Q is an approximate flow rate used only as a visual aid in finding the corrected flow on the calibration device. This value may indicate 5 to 15% error. This is for reference only!

- f. Use the "+/-" keys to move the pump speed up or down until the calibration device indicates the desired flow rate.

- g. When a stable reading has been achieved, press the "ENTER" key to store the flow rate.
- h. Exit the Setup menu and return to the "MAIN IDLE DISPLAY".

CALIBRATIONS ARE NOT AFFECTED UNTIL THE ENTER KEY IS PRESSED AND THE PUMP IS RUNNING.

- i. Record pre- and post- flow measurements and adjustments in the logbook.

6. Conducting the Sampling Event

- a. Visually inspect and ensure all O-rings are in place and secure. Replace if necessary.
- b. Always ensure that samples and unused ERG Cr+6 Filter Holder Modules are transported to and from the site cold.
- c. Confirm all cables (electrical connections) are secure, and that exterior connections are protected from the elements.
- d. Record activities, site observations, and maintenance activities in logbook.
- e. Turn on the PQ167R by pushing the "ON/OFF" button. If a message is blinking on the display, press "ENTER" to proceed to the "MAIN IDLE DISPLAY". Then press "RESET" to clear prior run data.
- f. Conduct an initial flow check (verification) by following the instructions in Section 4. Verification. Record the measurement from the flow standard on the *Ambient Hexavalent Chromium Data Sheet* under the "Field Setup" section on the "Initial Rotameter Setting".
- g. Following the flow check, the screen display should read:

ET0000Min TS00.00M (Date)

Q(Flow)Lpm T(Time) Bty(Capacity)%

(Date) – today's date in military notation; e.g., 01JAN= January 1st

(Flow) - the current flow rate selected to be regulated.

(Time) - military time; e.g., 13:08= 13 Hours 8 Minutes or 1:08 PM

(Capacity) - remaining charge in the internal battery.

- h. Press "SETUP". The screen will read; "Select FLOW RATE"

The flow rate value will be blinking.

- i. The flow rate should read 15.0 Lpm. If it does not read 15.0 Lpm, the unit must be calibrated to 15.0 Lpm. See calibration section for adjusting target flow rate and calibration.
- j. Press "SETUP". This is the date and time screen.

The screen should read;

Set DATE and TIME

(dd) (mmm) (yyyy) (time)

- k. DAY: Press ENTER and change by pressing the + or - key. When the day is correct, press ENTER.

MONTH: To change, press + or - key. When correct, press ENTER.

YEAR: To change, press + or - key. When correct, press ENTER.

TIME (hrs): To change, press + or - key. When correct, press ENTER.

TIME (min): To change, press + or - key. When correct, press ENTER.

When date and time are correct press "SETUP"

- l. This is the sample start screen which reads;

Set START DATE and TIME

(dd) (mmm) 00:00 Off

This screen allows you to set a start date and time for a sampling run. The default is set to midnight the next day. To designate your own start date and time:

DAY: Press ENTER and change by pressing the + or - key. When the day is correct, press ENTER.

MONTH: To change, press + or - key. When correct, press ENTER.

YEAR: To change, press + or - key. When correct, press ENTER.

TIME (hrs): To change, press + or - key. When correct, press ENTER.

TIME (min): To change, press + or - key. When correct, press ENTER

- m. Enable the run by setting the "On/Off" function on the screen to "On".
WARNING: The sampler will not automatically activate if this option is set to "Off".

- n. Press "SETUP"

The screen will read;

Set RUN TIME

Hours: 24 Min: 00 On

Set to 24 hours 0 minutes. The default is always 24 hrs 0 min, the required sample duration. If the sample time needs to be modified, adjust as instructed in step 6 and 8.

- o. Press "SETUP". The screen will return to the "MAIN IDLE DISPLAY".
WARNING: DO NOT PRESS THE RESET BUTTON AT THIS TIME AS THE START TIME AND RUN TIME WILL DEFAULT.

- p. Press "RUN/STOP"

If the START TIME ENABLE is set to "On" then the message "Alarm Triggered Run..." followed by "PQ100 Powering Down" will appear briefly. The PQ100 is now waiting for the internal real time clock to achieve the designated start time and will then power itself on and begin the sampling run. If the START TIME ENABLE is set to "Off" then the pump will begin to run immediately. If this occurs, press RUN/STOP and begin back at step 2 ensuring START TIME ENABLE is set to "On".

- 7. Installing the ERG Cr+6 Filter Holder Module (NOTE: Gloves must be changed for each sample, i.e. between retrieving a sample and preparing a new run gloves MUST be changed to prevent cross contamination).
 - a. Remove the sample inlet cover on the stainless steel probe and make sure there is no contamination on the probe.
 - b. Put on a clean pair of powder-free gloves.
 - c. Take the ERG Cr+6 Filter Holder Module storage container from the cooler and carefully remove the module. The module may be in a plastic bag. Return the bag to the container for use in the collection procedure.
 - d. Make sure the glass funnel is securely attached to the filter holder. Loosen the small top nut on the filter container. Arrows will be present on the

filter holder showing air flow direction and they should always point to the end of the sample probe line.

- e. Holding the module with the glass funnel facing down, slide the probe into the top fitting of the filter module and tighten the nut. Tighten the nut until the ERG Cr+6 Filter Holder Module is securely fastened to the probe. Do not overtighten the plastic nut.

(Note: If running a field blank, repeat steps 1 through 5, count to 10, and then remove the field blank filter holder module and place it back into the antistatic bag. Label the bag to designate the filter module as a field blank. Log the filter ID as field blank in the comments section of the ERG Hexavalent Chromium Sample Data Sheet. The field blank must be run before the sample filter module is fastened to the probe).

- 8. Sample Recovery and Data Collection-NOTE: Gloves must be changed for each sample, i.e. between retrieving a sample and preparing a new run, gloves MUST be changed to prevent cross contamination.
 - a. Record pertinent data on sample sheets. This information will be on the "MAIN STATUS SCREEN".
 - b. Conduct a final flow check (verification) by following the instructions in section 4-Verification. Record the measurement from the flow standard on the *Ambient Hexavalent Chromium Data Sheet* under the "Field Setup" section, "Final Rotameter Reading".
 - c. Put on a clean pair of powder free gloves
 - d. Take the module storage container from the cooler, open, and set aside
 - e. While holding the ERG Cr+6 Filter Holder Module, loosen the top nut holding the module to the sample inlet and slide the module off the stainless steel probe.
 - f. Place the ERG Cr+6 Filter Holder Module including glass funnel in the plastic bag and place back into the storage container. Place the storage container into a cooler with ice substitutes.
 - g. Place cover back on end of probe line.
 - h. Data may be downloaded to a laptop using the PQ100/200 DOWNLOAD SOFTWARE. ERG does not require this data, but direction can be found in the BGI PQ167 Quick Start document, pages 16 and 17.

9. Sample Shipping - The Cr+6 Filter Holder Module container must be packed in a cooler with ice substitutes and shipped overnight cold to ERG. The sample paperwork must be included in the shipment. Use the pre-filled out FedEx label provided by ERG, and fill out the "Sender" section with the sampling agency's address and phone number. Send priority overnight to ERG.

K. **Records Management**

The BGI PQ167R instrument may be used as a part of a broad range of project types, and the management of records and data from the operation of the PQ100 instrument are dependent upon the type of project for which it is used. Therefore, operation records and data from the PQ167R will be supplied to the Project Manager for inclusion in the project file. In this way Cr+6 information and data will be managed in accordance with other records and data from the same project.

L. **Quality Assurance/Quality Control**

1. Flow Calibration - A flow verification must be completed at the beginning of the study period. If the verification does not compare within 4%, the flow must be calibrated. Document all quality assurance activities in the logbook.
2. Flow Verifications - The flow must be verified or checked at the beginning and end of the sampling event to determine an average sample flow, document all quality assurance activities and observations in the logbook.
3. Independent Audits - If possible, it is recommended that an independent flow check of the sampler be conducted at some point during the study. This check may be conducted by a state or local agency's quality assurance team or independent audit program.

M. **References**

1. BGI Inc. PQ167 Quick Start Guide (Using the PQ100 Immediately) Revision "G"
2. BGI Inc. PQ100 Air Sampler Instruction Manual PM10 Reference Sampler

To: Salazar, Matt[Salazar.Matt@epa.gov]
Cc: Chow, Alice[chow.alice@epa.gov]; Hastings, Janis[Hastings.Janis@epa.gov]; Steiner, Cyntia[Steiner.Cyntia@epa.gov]
From: McClintock, Katie
Sent: Sun 3/6/2016 7:00:51 AM
Subject: Gallo Glass in Modesto, CA
[Gallo Complaint 022715.pdf](#)
[gallo-wine-bottle-maker-sued-b.pdf](#)

Enforcement confidential, pre-decisional

Matt,

I think you are aware of the color glass issue in Portland. I am doing some more research on glass and metals emissions and came across the attached article on Gallo Glass in Modesto, CA. I am sending to you and letting you know of additional information that might further our general investigation into colored glass metals emissions, but we may also want to consider adding this (and other container plants based on chromium and lead emissions) to our “list.” I am cc’ing Alice Chow in R3 who is leading the investigatory effort and my air director Jan Hastings. I don’t know if you are the right person to look into this yet or your air office, but I thought I’d start with you. If you, Alice or Jan think anyone else should get this, feel free to send along. Sorry this is so long, but want to give you a good picture as quickly as possible.

California Department of Toxic Substances Control sued Gallo Glass Company in 2015 for allegedly storing and recycling hazardous dust containing arsenic, lead, and selenium, and cadmium for 6 years. They were collecting the dust in their air pollution control device and re-introducing it as an ingredient in the glass-making process. I am also attaching the complaint. It states that “EP sludge contains concentrations of lead, arsenic, cadmium, and selenium above regulatory thresholds...” The way it is written, I am not sure if this is a finding here or a general statement about EP dust, but it would be very good to find out.

TRI thresholds aren’t necessarily useful here (since the art plants in Portland aren’t above the thresholds despite ambient impacts), but in 2014, they are reporting lead, chromium, and disturbingly and interestingly, mercury. They reported nickel and cobalt in other years. My impression from previous knowledge about this plant was that they were primarily a wine bottle manufacturer but that they also fulfill contracts for others during the off season, which may explain their weirder selection of metals for different colors. I think Cyntia Steiner might have a lot of info on this as well, so I am cc’ing her in case she wants to chime in, but I know she isn’t in air anymore.

I don't know how these requests will fit into the larger picture, but learning more about this facility, its metals usages and its emissions would be useful for many reasons. The article references arsenic and cadmium, which have been two of the three metals of focus in Portland (chromium is third). Is it possible to confirm if they are using these and how much? It looks like at least one furnace is controlled with a baghouse or ESP given the complaint. It would be good to confirm if they have any uncontrolled capacity. I'd love to see if they have any performance tests and if we can learn about metals emissions (both control efficiency and metals detected). It looks like they put the ESP on in 1995 so presumably they have some source tests. It would also be interesting to look to see if this source notified as subject to Subpart SSSSSS and has tested in compliance. Lastly, the use of mercury is odd and I haven't seen that elsewhere (though we still have more questions than answers in general). It would be great to learn why they are using mercury and see if other facilities might be using as well.

I want to note that today I also got a chance to look more into TRI reports from container glass manufacturers like Gallo in the nation. I had known that Ardagh Glass in Seattle reported lead and chromium emissions and Owens-Brockway in Portland reported lead emissions, but I am learning that most container seem to report lead emissions and at least several are reporting chromium (Ardagh in Madera, CA is). I am not sure where this knowledge about container glass will go, but wanted to let you know that Gallo might be the tip of the iceberg expanding our learning effort on this.

Thanks for your time and help.

Katie McClintock

Air Enforcement Officer

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Department of Toxic Substances Control

Pursuant to Government Code § 6103,
the State of California is exempt from
filing fees

ENDORSED
FILED
ALAMEDA COUNTY

FEB 27 2015

CLERK OF THE SUPERIOR COURT
By Louis Staley, Jr.

9 SUPERIOR COURT OF THE STATE OF CALIFORNIA
10 COUNTY OF ALAMEDA
11
12
13

RG15760440

14 **PEOPLE OF THE STATE OF**
15 **CALIFORNIA, *ex rel.* BARBARA A. LEE,**
16 **DIRECTOR OF THE CALIFORNIA**
DEPARTMENT OF TOXIC
SUBSTANCES CONTROL

Case No.

**COMPLAINT FOR CIVIL PENALTIES
AND INJUNCTIVE RELIEF**

(Health and Safety Code §§ 25100 et seq.)

17 Plaintiff,

18 v.

19 **GALLO GLASS COMPANY, AND DOES 1**
20 **THROUGH 50, INCLUSIVE**

21 Defendants.
22
23
24
25
26
27
28

COMPLAINT FOR CIVIL PENALTIES AND INJUNCTIVE RELIEF

1 Plaintiff, the People of the State of California, *ex rel.* Barbara A. Lee, Director of the
2 California Department of Toxic Substances Control, alleges as follows:

3 **PRELIMINARY STATEMENT**

4 1. Plaintiff brings this action against defendant Gallo Glass Company ("Gallo Glass") to
5 address violations of the California Hazardous Waste Control Law, Chapter 6.5 of Division 20 of
6 the California Health and Safety Code ("HWCL"), and its implementing regulations. The HWCL
7 and its implementing regulations establish comprehensive "cradle to grave" standards for the
8 generation, storage, transportation, treatment, and disposal of hazardous waste in California.

9 2. Plaintiff seeks injunctive relief and civil penalties against Defendants pursuant to
10 sections 25181, 25184, 25189 and 25189.2 of the Health and Safety Code for violations of the
11 HWCL.

12 **PLAINTIFF**

13 3. The California Department of Toxic Substances Control ("Department" or DTSC) is
14 a state agency organized and existing pursuant to sections 58000 et seq. of the California Health
15 and Safety Code. The Department is the state agency responsible for administering and enforcing
16 the provisions of the HWCL, and the implementing regulations set forth in the California Code of
17 Regulations, title 22, Division 4.5, section 66260.1 et seq. ("Title 22").

18 4. Barbara A. Lee, is the Director of the Department.

19 5. Pursuant to Sections 25181(a) and 25182 of the California Health and Safety Code,
20 the Attorney General of the State of California is authorized, at the request of the Department, to
21 commence an action for civil penalties and injunctive relief under the HWCL in the name of the
22 People of the State of California. The Department has made such a request to the Attorney
23 General.

24 **DEFENDANTS**

25 6. Defendant Gallo Glass Company ("Gallo Glass") is a corporation organized and
26 existing under the laws of the State of California, and is authorized to conduct business in the
27 State of California. Defendant Gallo Glass owns and/or operates a facility, located at 605 S.
28 Santa Cruz Avenue, Modesto, California ("Facility"), where the manufacturing of glass bottles

1 results in the generation, storage, disposal and treatment of hazardous waste. The Facility is
2 surrounded by residential neighborhoods to the north, east, and south. Defendant Gallo Glass is a
3 "person," as that term is defined by Health and Safety Code section 25118. Defendant Gallo
4 Glass is also a "generator," and an "owner or operator" as those terms are defined by California
5 Code of Regulations, title 22, section 66260.10. In this Complaint when reference is made to any
6 act or omission of defendant Gallo Glass or "Defendants," such allegations shall include the acts
7 and omissions of owners, officers, directors, agents, employees, contractors, affiliates, and/or
8 representatives of defendant Gallo Glass while acting within the course and scope of their
9 employment or agency on behalf of defendant Gallo Glass during the relevant time periods.

10 7. Defendants DOES 1-50 are the officers, agents, employees, servants, subsidiaries,
11 affiliates, parent companies, holding companies, owners, operators, successors or others acting in
12 interest or concert with Defendant Gallo Glass. Plaintiff is ignorant of the true names of
13 Defendants sued herein as DOES 1-50. When the names of these Defendants have been
14 ascertained, Plaintiff will seek leave to amend the complaint to substitute the true name of each
15 DOE Defendant in place of the fictitious name.

16 8. Each reference in this complaint to "Defendant" or "Defendants" refers to the named
17 Defendant or Defendants and also to all Defendants under fictitious names.

18 JURISDICTION AND VENUE

19 9. The Superior Court has jurisdiction pursuant to Article VI, Section 10 of the
20 California Constitution, and California Health and Safety Code section 25181.

21 10. Venue is proper in this Court pursuant to California Health and Safety Code section
22 25183, because Alameda County is the county in which the Attorney General has an office
23 nearest to Stanislaus County in which at least one of Defendants' principal offices is located.

24 11. Plaintiff and Defendant Gallo Glass entered into an agreement to toll any applicable
25 statutes of limitation from October 31, 2013, through March 31, 2014 (the "Tolling Period"),
26 which will not be included in computing the time limited by any statutes of limitation applicable
27 to the causes of action based on claims covered by the tolling agreement. Those claims include
28

1 the claims alleged in this action. This Complaint has been filed within five years of the Plaintiff
2 discovering the HWCL violations alleged herein.

3 **HWCL STATUTORY AND REGULATORY BACKGROUND**

4 12. The State of California has enacted a comprehensive statutory and regulatory
5 framework for the generation, handling, treatment, transport, and disposal of hazardous wastes.
6 The framework contained in the HWCL, and its implementing regulations, mandate a "cradle to
7 grave" registration, tracking, storage, treatment, and disposal system for the protection of the
8 public from the risks posed by hazardous wastes. Except where otherwise expressly defined in
9 this Complaint, all terms shall be interpreted consistent with the HWCL and Title 22.

10 13. California administers the HWCL in lieu of federal administration of the federal
11 Resource Conservation and Recovery Act ("RCRA"), which is codified at 42 United States Code
12 sections 6901 et seq., pursuant to Health & Safety Code sections 25101(d) and 25159-25159.9.
13 Federal law prohibits California from imposing any requirements less stringent than those
14 authorized under RCRA. (42 U.S.C. § 6929.) The HWCL has stricter requirements for
15 regulating hazardous waste than RCRA.

16 14. The HWCL charges the Department with the responsibility to adopt standards and
17 regulations for the management of hazardous waste to protect the public health and environment.
18 (Health & Saf. Code, § 25150.) Accordingly, the Department has promulgated regulations setting
19 forth numerous and extensive health-protective requirements for the day-to-day operation of
20 hazardous waste generators, transporters, as well as owners and operators of hazardous waste
21 facilities. (See Cal. Code. Regs., tit. 22, § 66262.1 et seq.)

22 15. Health and Safety Code section 25124(a) defines a "waste" [as] any solid, liquid,
23 semisolid, or contained gaseous discarded material that is not excluded by this chapter or by
24 regulations adopted pursuant to this chapter." "Discarded materials" include, among other things,
25 any material that is:

- 26 (1) relinquished (which includes disposed of, burned or incinerated);
27 (2) recycled or accumulated, stored, or treated before recycling, except as provided in
28 Health and Safety Code section 25143.2; or

1 (3) poses a threat to public health or the environment and is not timely and adequately
2 labeled or not timely packaged in an adequate container, or is considered inherently waste like, as
3 specified in regulations adopted by the Department. (Health & Saf. Code, § 25124, subds. (b)(1),
4 (b)(2) and (b)(3).)

5 16. A "hazardous waste" is a waste that meets any of the criteria established by the
6 Department. (Health & Saf. Code, §§ 25117 and 25141.) The criteria consist of lists of particular
7 hazardous wastes and waste exhibiting certain characteristics.

8 17. Recycled material means a recyclable material which has been used or reused, or
9 reclaimed. (Health & Saf. Code, § 25121(a).) Recyclable material means a hazardous waste that
10 is capable of being recycled. (Health & Saf. Code, § 25120.5.) Recycled material is subject to
11 full regulation as hazardous waste unless it can qualify for one of the recycling exemptions or
12 exclusions in Health and Safety Code section 25143.2. Even hazardous waste that qualifies for a
13 recycling exemption is regulated because it must initially, and continue to, meet certain
14 requirements under the HWCL. However, it does not need to meet all the management
15 requirements for hazardous waste.

16 18. The person claiming the recycling exemption must demonstrate that *bona fide*
17 recycling is occurring. Recycling of material that is only marginally effective for the claimed use
18 or use of recyclable material in excess of the amount necessary are both indicators of sham
19 recycling (surrogate disposal) and not within the scope of the recycling exemptions. (See 80
20 Fed.Reg. 1774 (January 13, 2015); (Health & Saf. Code, § 25143.10(a)(3)(B).))

21 19. Health and Safety Code section 25143.2 (f)(2) requires that the person claiming the
22 exemption/exclusion maintain adequate records to demonstrate *bona fide* recycling, furnish them
23 upon request to the Department pursuant to Health & Safety Code section 25143.2(f)(1)(B) , and
24 demonstrate to the satisfaction of the Department that the requirements of any claimed
25 exemption/exclusion are met. (See also Cal. Code. Regs., tit. 22, § 66261.2(g).)

26 20. The HWCL has a more inclusive definition of "hazardous waste" than does federal
27 law. Hazardous wastes that are regulated under California law but not federal law are known as
28 "non-RCRA hazardous wastes." (Health & Saf. Code, § 25117.9.)

1 21. The HWCL, at Health and Safety Code section 25201(a), provides that an owner
2 or operator of a hazardous waste management facility may not "accept, treat, store, or dispose of a
3 hazardous waste at the facility, area, or site, unless the owner or operator holds a hazardous waste
4 facilities permit or other grant of authorization from the Department to use and operate the
5 facility, area, or site"

6 22. In general, a generator that generates 1,000 kilograms or more of hazardous waste
7 per month may accumulate that hazardous waste onsite for up to ninety (90) days without
8 authorization from the Department provided that the generator complies with certain
9 requirements, including, but not limited to, the requirements specified in California Code of
10 Regulations, title 22, section 66262.34. (Health & Saf. Code, § 25123.3, subs. (b) and (c).)

11 23. A person that generates a waste must determine if the waste is hazardous using the
12 methods outlined in California Code of Regulations, title 22, sections 66262.11, and 66260.200.
13 If the waste is hazardous, the generator must manage it in accordance with the statutes and
14 regulations governing generators of hazardous wastes. (See Cal. Code. Regs., tit. 22, §§
15 66262.11(d) and 66260.200(c).)

16 24. A person who generates a hazardous waste is subject to the requirements prescribed
17 in chapter 6.5 of division 20 of the Health and Safety Code (commencing with section 25100). A
18 generator who treats, stores, or disposes of hazardous waste on-site shall also comply with the
19 applicable standards and permit requirements set forth in chapters 14, 15, 16, 18 and 20 of
20 division 4.5, California Code of Regulations, title 22, section 66260.1 et seq. (Cal. Code. Regs.,
21 tit. 22, § 66262.10.)

22 **ENFORCEMENT AUTHORITY UNDER THE HWCL**

23 25. As is relevant to this proceeding, the HWCL authorizes the Court to impose civil
24 penalties under two distinct and alternative statutory provisions. Section 25189 of the Health and
25 Safety Code creates liability for any negligent or intentional violation of the HWCL. Section
26 25189.2 is a strict liability provision, which creates liability for any violation of the HWCL. A
27 person may not be held liable for a civil penalty imposed under section 25189 and for a civil
28 penalty imposed under section 25189.2 for the same act. (Health & Saf. Code, § 25189.2(f).)

26. As is relevant to this action, the HWCL authorizes the Court to impose a civil penalty of up to twenty five thousand dollars (\$25,000) for each violation of a separate provision of the HWCL and/or implementing regulations. For continuing violations, the HWCL authorizes the Court to impose a penalty of up to twenty five thousand dollars (\$25,000) for each day that a violation continues. (Health & Saf. Code, §§ 25189(b) and 25189.2(b).) For intentional disposals of hazardous waste, the HWCL sets the minimum civil penalty at \$1,000 per violation. (Health & Saf. Code, § 25189(c).)

27. The HWCL, at Health and Safety Code sections 25181 and 25184, authorizes and directs the Court to enjoin any ongoing or potential violation of the HWCL.

28. Section 25181 of the Health and Safety Code provides that when the Department determines that any person has engaged in, is engaged in, or is about to engage in any acts or practices which constitute or will constitute a violation of any provision of the HWCL or any rule or requirement issued or promulgated thereunder, and when requested by the Department, the Attorney General may make application to the superior court for an order enjoining such acts or practices, or for an order directing compliance, and upon a showing by the Department that such person has engaged in or is about to engage in any such acts or practices, a permanent or temporary injunction, restraining order, or other order may be granted.

29. Health and Safety Code section 25184 provides that in civil actions brought pursuant to the HWCL in which an injunction or temporary restraining order is sought:

It shall not be necessary to allege or prove at any stage of the proceeding that irreparable damage will occur should the temporary restraining order, preliminary injunction, or permanent injunction not be issued; or that the remedy at law is inadequate, and the temporary restraining order, preliminary injunction, or permanent injunction shall issue without such allegations and without such proof.

GENERAL ALLEGATIONS

30. At all times relevant herein, Defendants, and/or their predecessors in interest, owned and/or operated the Facility.

31. Defendants mix glass cullet (recycled glass) and raw materials into a batch recipe, which is then put in a furnace to manufacture glass bottles at the Facility.

1 32. In or around 1995, Defendants installed an air-pollution control device called an
2 Electrostatic Precipitator (EP) to capture certain regulated pollutants (including particulate
3 matter) from furnace exhaust gas that would otherwise be emitted to the air. The air pollution
4 control device has been operational since installation, except for possible shutdowns for
5 maintenance or other events.

6 33. The captured exhaust gas from the furnace goes through the EP unit which produces
7 EP sludge. As a solid waste generated from an air pollution control device, the effluent from the
8 EP unit is "sludge" as defined in California Code of Regulations, title 22, section 66260.10. EP
9 sludge is considered a RCRA hazardous waste because it exhibits the toxicity characteristic under
10 RCRA's Toxicity Characteristic Leaching Procedure. In particular, EP sludge contains
11 concentrations of lead, arsenic, cadmium, and selenium above regulatory thresholds, and EP
12 sludge is therefore subject to regulation as hazardous waste under the HWCL once it exits the EP
13 unit. (Health & Saf. Code, § 25201.12.) EP sludge is also a "recyclable material" (hazardous
14 waste) within the meaning of Health and Safety Code section 25120.5.

15 34. With respect to EP sludge collected from the air pollution control devices, Defendants
16 engaged in surrogate disposal of EP sludge by using it to make glass bottles. Defendants claim
17 EP sludge was being used as a substitute for salt cake, a raw ingredient used in the making of
18 glass bottles, but have not provided the Department with the requested information necessary to
19 confirm that claim. Based on information and belief, Defendants reaped a substantial economic
20 benefit by failing to properly dispose of all EP sludge to an authorized disposal facility.

21 35. Between 1995 and 2014, Defendants collected tons of EP sludge and mechanically
22 conveyed it to a storage tank (aka EP sludge silo) where the EP sludge was illegally stored. A
23 significant amount of the EP sludge was subsequently illegally treated in the furnaces by adding it
24 to the glass batch ingredient mix from which Defendants' glass bottles are made. The EP sludge
25 that did not make it into the silo or furnace was either unlawfully released into the environment or
26 disposed of as a hazardous waste to an authorized landfill.

27 36. On or about September 29, 2009, October 7, 2009, and February 3, 2011,
28 representatives of the Department conducted on-site inspections of Defendants' Facility.

1 **FIRST CAUSE OF ACTION**

2 (Intentional or Negligent Disposal of Hazardous Waste)
3 (Health & Saf. Code, §§ 25189(c) and (d), 25201(a), 25250.4(a), 25250.5(a))

4 37. Paragraphs 1 through 36 above are incorporated by reference as though fully set forth
5 herein.

6 38. In relevant part, Health and Safety Code section 25201(a) provides that no owner or
7 operator of a hazardous waste disposal facility or disposal site shall accept, treat, store, or dispose
8 of a hazardous waste at the facility, area, or site, unless the owner or operator holds a hazardous
9 waste facilities permit or other grant of authorization from the Department.

10 39. In relevant part, Health and Safety Code section 25189(c) forbids any person from
11 intentionally disposing, or causing the disposal, of a hazardous waste at an unauthorized location.
12 Further, Health and Safety Code section 25189(d) forbids any person from negligently disposing
13 of hazardous waste at an unauthorized location.

14 40. In relevant part, Health and Safety Code section 25250.4(a) provides that used oil
15 shall be managed as hazardous waste in accordance with the HWCL. Health and Safety Code
16 section 25250.5(a) further provides that the disposal of used oil is prohibited unless authorized
17 under other provisions of law.

18 41. On and prior to September 29, 2009, October 7, 2009, and February 3, 2011, and
19 continuing thereafter according to proof, Defendants violated Health and Safety Code sections
20 25189(c), 25189(d), and 25201(a) by unlawfully and intentionally and/or negligently disposing,
21 or causing the disposal, of EP sludge, a hazardous waste, by:

22 (a) engaging in surrogate disposal: instead of sending all EP sludge to an
23 authorized hazardous waste landfill, Defendants put tons of the EP sludge back into a furnace as
24 part of its glass batch mix, claiming it was substituting EP sludge for raw materials to make glass
25 bottles; and

26 (b) depositing EP sludge at various locations throughout the Facility, including on
27 the ground, on the walls, on the air pollution control equipment, and near the EP sludge storage
28 silo tank, and by tracking it outside the building.

1 42. On and prior to September 29, 2009, October 7, 2009, and February 3, 2011, and
2 continuing thereafter according to proof, Defendants violated Health and Safety Code sections
3 25189(c), 25189(d), 25201(a), and 25250.5(a) by unlawfully and intentionally and/or negligently
4 disposing of, or causing the disposal of, used oil without authorization, by:

5 (a) disposing of used oil by pumping the hazardous waste into glass batch mixes
6 and incinerating it in the furnace;

7 (b) disposing of used oil by combining the oily sludge from the Facility's used oil
8 treatment system with other waste streams in a roll-off bin and disposing of this hazardous waste
9 as a non-hazardous waste at the Clean Harbors Disposal Facility, located at 2500 West Lokern
10 Road in Buttonwillow, California; and

11 (c) discharging used oil directly to a sewer.

12 43. Pursuant to Health and Safety Code sections 25189(b), 25189(c) and/or 25189(d),
13 Defendants are liable for civil penalties according to proof based on these intentional and/or
14 negligent violations. For each intentional disposal of hazardous waste in violation of Health and
15 Safety Code section 25189(c), Defendants each are subject to a civil penalty of not less than one
16 thousand dollars (\$1,000) and up to twenty five thousand dollars (\$25,000). For each negligent
17 disposal of hazardous waste in violation of Health and Safety Code section 25189(d), Defendants
18 each are subject to a civil penalty of up to twenty five thousand dollars (\$25,000). Each violation
19 of a separate provision of the HWCL and/or its implementing regulations is subject to an a civil
20 penalty of up to twenty five thousand dollars (\$25,000). For a continuing violation, each day a
21 violation continues is subject to a civil penalty of up to twenty five thousand dollars (\$25,000).
22 For intentional disposals of hazardous waste, the HWCL sets the minimum civil penalty at \$1,000
23 per violation. (Health & Saf. Code, § 25189(c).) Pursuant to Health and Safety Code section
24 25181, Defendants should also be enjoined from further violations of the HWCL.

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SECOND CAUSE OF ACTION
(Strict Liability for Disposal of Hazardous Waste)
(Health & Saf. Code, §§ 25189.2(c), 25201(a), 25250.4(a), 25250.5(a))

44. Paragraphs 1 through 43 above are incorporated by reference as though fully set forth herein.

45. In relevant part, Health and Safety Code section 25201(a) provides that no owner or operator of a hazardous waste disposal facility or disposal site shall accept, treat, store, or dispose of a hazardous waste at the facility, area, or site, unless the owner or operator holds a hazardous waste facilities permit or other grant of authorization from the Department.

46. In relevant part, Health and Safety Code section 25189.2(c) is a strict liability provision that forbids any person from disposing, or causing the disposal, of a hazardous waste at an unauthorized location.

47. In relevant part, Health and Safety Code section 25250.4(a) provides that used oil shall be managed as hazardous waste in accordance with the HWCL. Health and Safety Code section 25250.5(a) further provides that the disposal of used oil is prohibited unless authorized under other provisions of law.

48. On and prior to September 29, 2009, October 7, 2009, and February 3, 2011, and continuing thereafter according to proof, Defendants violated Health and Safety Code sections 25189.2(c) and 25201(a) by unlawfully disposing, or causing the disposal, of EP sludge, a hazardous waste, by:

(a) engaging in surrogate disposal: instead of sending all EP sludge to an authorized hazardous waste landfill, Defendants put tons of the EP sludge back into a furnace as part of its glass batch mix, claiming it was substituting EP sludge for raw materials to make glass bottles; and

(b) depositing EP sludge at various locations throughout the Facility, including on the ground, on the walls, on the air pollution control equipment, and near the EP sludge storage silo tank, and by tracking it outside the building.

49. On and prior to September 29, 2009, October 7, 2009, and February 3, 2011, and continuing thereafter according to proof, Defendants violated Health and Safety Code sections 25189.2(c), 25201(a), and 25250.5(a) by unlawfully disposing of, or causing the disposal of, used oil without authorization, by:

(a) disposing of used oil by pumping the hazardous waste into glass batch mixes and incinerating it in the furnace;

(b) disposing of used oil by combining the oily sludge from the Facility's used oil treatment system with other waste streams in a roll-off bin and disposing of this hazardous waste as a non-hazardous waste at the Clean Harbors Disposal Facility, located at 2500 West Lokern Road in Buttonwillow, California; and

(c) discharging used oil directly to a sewer.

50. Pursuant to Health and Safety Code sections 25189.2(b) and 25189.2(c), Defendants are strictly liable for civil penalties according to proof based on these violations. Each violation of a separate provision of the HWCL and/or its implementing regulations is subject to a civil penalty of up to twenty five thousand dollars (\$25,000). For a continuing violation, each day a violation continues is subject to a civil penalty of up to twenty five thousand dollars (\$25,000). Pursuant to Health and Safety Code section 25181, Defendants should also be enjoined from further violations of the HWCL.

THIRD CAUSE OF ACTION
(Illegal Storage of Hazardous Waste)
(Health & Saf. Code, § 25201(a))

51. Paragraphs 1 through 50 above are incorporated by reference as though fully set forth herein.

52. In relevant part, Health and Safety Code section 25201(a) provides that no owner or operator of a storage facility shall accept, treat, store, or dispose of a hazardous waste at the facility, area, or site, unless the owner or operator holds a hazardous waste facilities permit or other grant of authorization from the Department.

53. In relevant part, Health and Safety Code section 25123.3(b)(4)(A) provides that a hazardous waste "storage facility" is a facility where hazardous waste is held onsite for any

1 period of time unless the hazardous waste is held in a container or tank in accordance with the
2 Department's regulations.

3 54. Under California Code of Regulations, title 22, section 66262.34, a generator that
4 generates a 1,000 kilograms or more of hazardous waste per month is able to accumulate
5 hazardous waste on site for 90 days or less without a permit or grant of interim status from the
6 Department only if it complies with certain requirements including, but not limited to, placing the
7 hazardous waste in proper containers or tanks and properly assessing and labeling the containers
8 or tanks. (See Cal. Code. Regs., tit. 22, §§ 66262.34(a) and 66262.34(f).) If the generator fails to
9 meet all the requirements for the 90 day accumulation period, it is not authorized to accumulate
10 any hazardous waste at all.

11 55. In relevant part, California Code of Regulations, title 22, section 66265.173(a)
12 provides that a container holding hazardous waste shall always be closed during transfer and
13 storage, except when it is necessary to add or remove waste.

14 56. On and prior to September 29, 2009, October 7, 2009, and February 3, 2011, and
15 continuing thereafter according to proof, Defendants stored hazardous waste, including EP
16 sludge, at the Facility without a permit or authorization from the Department in violation of
17 Health and Safety Code section 25201(a) and without complying with California Code of
18 Regulations, title 22, sections 66262.34(a), 66262.34(f), and section 66265.173 with respect to
19 subparagraphs (a)(ii) and (b). Defendants unlawfully stored EP sludge at the Facility in a silo
20 storage tank that had not been assessed and/or certified by an engineer as being capable of
21 holding the EP sludge as required by California Code of Regulations, title 22, section
22 66265.192(a).

23 57. On and prior to September 29, 2009, October 7, 2009, and February 3, 2011, and
24 continuing thereafter according to proof, Defendants stored hazardous waste at the Facility
25 without a permit or authorization from the Department in violation of Health and Safety Code
26 section 25201(a), and without complying with California Code of Regulations, title 22, sections
27 66262.34(a), 66262.34(f), and, with respect to used oil, in violation of section 66266.130(a), as
28 follows:

1 (a) used oil was combined with other waste streams and stored in an uncovered
2 roll-off bin at the Facility that was not properly labeled as a hazardous waste; and

3 (b) used oil was stored in tanks and other parts of the used oil treatment system that
4 were not properly labeled as a hazardous waste and had not been assessed and/or certified by an
5 engineer as being capable of holding used oil as required by California Code of Regulations, title
6 22, section 66265.192(a). These tanks include, but are not limited to, the reclaim byproduct
7 holding tank, the reclaim system separator tank, and the "sludge oil" tank in the Facility's basement.

8 58. Pursuant to Health and Safety Code sections 25189(b) and/or 25189(e), Defendants
9 are liable for civil penalties according to proof based on these intentional or negligent violations.
10 In the alternative, Defendants are strictly liable for civil penalties according to proof pursuant to
11 Health and Safety Code section 25189.2(d). Each violation of a separate provision of the HWCL
12 and/or its implementing regulations is subject to a civil penalty of up to twenty five thousand
13 dollars (\$25,000). For a continuing violation, each day a violation continues is subject to a civil
14 penalty of up to twenty five thousand dollars (\$25,000). Pursuant to Health and Safety Code
15 section 25181, Defendants should also be enjoined from further violations of the HWCL.

16 **FOURTH CAUSE OF ACTION**
17 (Illegal Treatment of Hazardous Waste)
18 (Health & Saf. Code, § 25201(a))

19 59. Paragraphs 1 through 58 above are incorporated by reference as though fully set forth
20 herein.

21 60. In relevant part, Health and Safety Code section 25201(a) provides that no owner or
22 operator of a treatment facility shall accept, treat, store, or dispose of a hazardous waste at the
23 facility, area, or site, unless the owner or operator holds a hazardous waste facilities permit or
24 other grant of authorization from the Department.

25 61. Health and Safety Code section 25123.5 defines treatment of a hazardous waste to
26 include any method, technique, or process which is designed to change the physical, chemical, or
27 biological character or composition of the hazardous waste, or which removes or reduces its
28 harmful properties or characteristics for any purpose.

1 62. On and prior to September 29, 2009, October 7, 2009, and February 3, 2011, and
2 continuing thereafter according to proof, Defendants violated Health and Safety Code section
3 25201(a) by unlawfully treating EP sludge, a hazardous waste, by mixing EP sludge with glass
4 cullet and raw materials in batch quantities and then introducing the mixture into the Facility
5 furnaces to make glass bottles without a permit or other authorization from the Department.

6 63. On and prior to September 29, 2009, October 7, 2009, and February 3, 2011, and
7 continuing thereafter according to proof, Defendants violated Health and Safety Code section
8 25201(a) by unlawfully treating used oil, a hazardous waste, without a permit or other
9 authorization from the Department. Defendants treated used oil by, at a minimum:

10 (a) separating used oil from water in a Coalescer (a tank for treating used oil);

11 (b) adding chemical anti-foaming agents to the used oil mixture in the Wemco (a tank
12 for treating used oil);

13 (c) separating used oil from water in the reclaim system separator tank via
14 flocculation, induced air flotation, dissolved air flotation, gravity separation, and phase
15 separation; and

16 (d) burning and/or incinerating used oil in the glass furnaces.

17 64. Pursuant to Health and Safety Code sections 25189(b) and/or 25189(e), Defendants
18 are liable for civil penalties according to proof based on this intentional or negligent violation(s).
19 In the alternative, Defendants are strictly liable for civil penalties according to proof pursuant to
20 Health and Safety Code section 25189.2(d). Each violation of a separate provision of the HWCL
21 and/or its implementing regulations is subject to a civil penalty of up to twenty five thousand
22 dollars (\$25,000). For a continuing violation, each day a violation continues is subject to a civil
23 penalty of up to twenty five thousand dollars (\$25,000). Pursuant to Health and Safety Code
24 section 25181, Defendants should also be enjoined from further violations of the HWCL.

25 **FIFTH CAUSE OF ACTION**

26 (Failure to Conduct Tank Assessment)
27 (Cal. Code Regs., tit. 22, § 66265.192(a))

28 65. Paragraphs 1 through 64 above are incorporated by reference as though fully set forth
herein.

1 66. In relevant part, California Code of Regulations, title 22, section 66265.192(a)
2 requires an owner or operator of a new tank system or components to obtain a written assessment
3 reviewed and certified by an independent, qualified, registered professional engineer attesting that
4 the new tank system or components has sufficient structural integrity and is acceptable for the
5 transferring, storing, and treating of hazardous waste before placing the tank system or
6 components in service.

7 67. In relevant part, California Code of Regulations, title 22, section 66260.10 defines
8 "tank system" as "a hazardous waste transfer, storage or treatment tank and its associated
9 ancillary equipment and containment system." That section also defines "component" as "any
10 constituent part of a unit or any group of constituent parts of a unit which are assembled to
11 perform a specific function..."

12 68. On and prior to September 29, 2009, October 7, 2009, and February 3, 2011, and
13 continuing thereafter according to proof, Defendants failed to obtain a written assessment for the
14 following hazardous waste tanks at the Facility as required by California Code of Regulations,
15 title 22, section 66265.192(a):

16 (a) EP sludge storage silo tank and its associated ancillary equipment and
17 containment system; and

18 (b) used oil treatment system storage tanks and their associated ancillary equipment
19 and containment systems, including the Wemco, the Coalescer, the reclaim byproduct holding tank,
20 the reclaim system separator tank, and the "sludge oil" tank in the basement.

21 69. Pursuant to Health and Safety Code section 25189(b), Defendants are liable for civil
22 penalties according to proof based on these intentional or negligent violations. In the alternative,
23 Defendants are strictly liable for civil penalties according to proof pursuant to Health and Safety
24 Code section 25189.2(b). Each violation of a separate provision of the HWCL and/or its
25 implementing regulations is subject to a civil penalty of up to twenty five thousand dollars
26 (\$25,000). For a continuing violation, each day a violation continues is subject to a civil penalty
27 of up to twenty five thousand dollars (\$25,000). Pursuant to Health and Safety Code section
28 25181, Defendants should be enjoined from violating the HWCL.

1 **SIXTH CAUSE OF ACTION**

2 (Failure to Conduct Daily Tank Inspections and Maintain Inspection Logs)
3 (Cal. Code Regs., tit. 22, § 66265.195(a))

4 70. Paragraphs 1 through 69 above are incorporated by reference as though fully set forth
5 herein.

6 71. In relevant part, California Code of Regulations, title 22, section 66265.195(a)
7 requires an owner or operator of a tank system to conduct daily inspections of tanks and to
8 document these inspections.

9 72. On and prior to September 29, 2009, October 7, 2009, and February 3, 2011, and
10 continuing thereafter according to proof, Defendants failed to conduct and document inspections
11 for the following hazardous waste tanks at the Facility as required by California Code of
12 Regulations, title 22, section 66265.195(a):

13 (a) EP sludge storage silo tank and its associated ancillary equipment and
14 containment system; and

15 (b) used oil treatment system storage tanks and their associated ancillary equipment
16 and containment systems, including the Wemco, the Coalescer, the reclaim byproduct holding
17 tank, the reclaim system separator tank, and the "sludge oil" tank in the basement.

18 73. Pursuant to Health and Safety Code section 25189(b), Defendants are liable for civil
19 penalties according to proof based on these intentional or negligent violations. In the alternative,
20 Defendants are strictly liable for civil penalties according to proof pursuant to Health and Safety
21 Code section 25189.2(b). Each violation of a separate provision of the HWCL and/or its
22 implementing regulations is subject to a civil penalty of up to twenty five thousand dollars
23 (\$25,000). For a continuing violation, each day a violation continues is subject to a civil penalty
24 of up to twenty five thousand dollars (\$25,000). Pursuant to Health and Safety section 25181,
25 Defendants should be enjoined from violating the HWCL.

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1 and/or containers at the Facility, in violation of California Code of Regulations, title 22, section
2 66262.34(a) and (f), and, with respect to "used oil," in violation of section 66279.21(b):

3 (a) EP sludge storage silo tank and its associated ancillary equipment and
4 containment system;

5 (b) a roll-off bin used by Defendants to capture EP sludge;

6 (c) used oil storage tanks in the used oil treatment system and their associated
7 ancillary equipment and containment systems, including but not limited to, the Coalescer, the Wemco,
8 the reclaim byproduct holding tank, the reclaim system separator tank, and the "sludge oil" tank in the
9 basement;

10 (d) roll-off bin containing used oil and other waste streams;

11 (e) three drums of glass-bead waste in the Facility's Mold Shop Blaster area;

12 (f) one roll-off bin of glass bead waste in the Facility's east parking lot; and

13 (g) six 55-gallon drums of hazardous waste located outside of the Mold Shop at the
14 Facility.

15 78. Pursuant to Health and Safety Code section 25189(b), Defendants are liable for civil
16 penalties according to proof based on these intentional or negligent violations. In the alternative,
17 Defendants are strictly liable for civil penalties according to proof pursuant to Health and Safety
18 Code section 25189.2(b). Each violation of a separate provision of the HWCL and/or its
19 implementing regulations is subject to a civil penalty of up to twenty five thousand dollars
20 (\$25,000). For a continuing violation, each day a violation continues is subject to a civil penalty
21 of up to twenty five thousand dollars (\$25,000). Pursuant to Health and Safety Code section
22 25181, Defendants should also be enjoined from further violations of the HWCL.

23 **EIGHTH CAUSE OF ACTION**

24 (Failure to Minimize Possibility of Release of Hazardous Waste)
(Cal. Code Regs., tit. 22, § 66265.31)

25 79. Paragraphs 1 through 78 above are incorporated by reference as though fully set forth
26 herein.

27 80. California Code of Regulations, title 22, section 66265.31 provides that "[f]acilities
28 shall be maintained and operated to minimize the possibility of a fire, explosion, or any

1 unplanned sudden or non-sudden release of hazardous waste or hazardous waste constituents to
2 air, soil, or surface water which could threaten human health or the environment.”

3 81. On and prior to September 29, 2009, and October 7, 2009, and continuing thereafter
4 according to proof, Defendants failed to properly maintain and operate the Facility to minimize
5 hazardous waste and/or hazardous waste constituent releases into the environment in violation of
6 California Code of Regulations, title 22, section 66265.31, as demonstrated by the following:

7 (a) EP sludge was observed on both the equipment and the floor near the high
8 density pump station, on paved concrete outside the door of the high density pump station, and
9 surrounding the EP sludge storage silo outside the main building; and

10 (b) Oily spills and sludge were observed on the equipment and on the floor around
11 the oil treatment system.

12 82. Pursuant to Health and Safety Code section 25189(b), Defendants are liable for civil
13 penalties according to proof based on these intentional or negligent violations. In the alternative,
14 Defendants are strictly liable for civil penalties according to proof pursuant to Health and Safety
15 Code section 25189.2(b). Each violation of a separate provision of the HWCL and/or its
16 implementing regulations is subject to a civil penalty of up to twenty five thousand dollars
17 (\$25,000). For a continuing violation, each day a violation continues is subject to a civil penalty
18 of up to twenty five thousand dollars (\$25,000). Pursuant to Health and Safety Code section
19 25181, Defendants should also be enjoined from further violations of the HWCL.

20 **NINTH CAUSE OF ACTION**

21 (Failure to Properly Train Personnel and Maintain Training Records)
22 (Cal. Code Regs., tit. 22, § 66265.16)

23 83. Paragraphs 1 through 82 above are incorporated by reference as though fully set forth
24 herein.

25 84. In relevant part, California Code of Regulations, title 22, section 66265.16(a)
26 provides that,

27 (1) facility personnel shall successfully complete a program of classroom instruction
28 or on-the-job training that teaches them to perform their duties in a way that ensures
the facility's compliance with the requirements of this chapter. The owner or operator
shall ensure that this program includes all the elements described in the document
required under subsection (d)(3) of this section.

1 ...
2 (3) At a minimum, the training program shall be designed to ensure that facility
3 personnel are able to respond effectively to emergencies by familiarizing them with
4 emergency procedures, emergency equipment, and emergency systems. . .

5 Section 66265.16, subdivisions (b) through (e), further provide that facility personnel shall
6 complete such required training within specified time limits and that the owner or operator shall
7 maintain appropriate written documentation of such training as set forth in said regulation.

8 85. On and prior to September 29, 2009, October 7, 2009, and February 3, 2011, and
9 continuing thereafter according to proof, Defendants failed to provide adequate emergency
10 contingency training and a training plan for its contract employees and failed to maintain the
11 appropriate written documentation of such training in violation of California Code of Regulations,
12 title 22, sections 66265.16(a) and (e).

13 86. Pursuant to Health and Safety Code section 25189(b), Defendants are liable for civil
14 penalties according to proof based on these intentional or negligent violations. In the alternative,
15 Defendants are strictly liable for civil penalties according to proof pursuant to Health and Safety
16 Code section 25189.2(b). Each violation of a separate provision of the HWCL and/or its
17 implementing regulations is subject to a civil penalty of up to twenty five thousand dollars
18 (\$25,000). For a continuing violation, each day a violation continues is subject to a civil penalty
19 of up to twenty five thousand dollars (\$25,000). Pursuant to Health and Safety Code section
20 25181, Defendants should also be enjoined from further violations of the HWCL.

21 **TENTH CAUSE OF ACTION**

22 (Failure to Provide Secondary Containment)
23 (Cal. Code Regs., tit. 22, § 66265.193)

24 87. Paragraphs 1 through 86 above are incorporated by reference as though fully set forth
25 herein.

26 88. In relevant part, California Code of Regulations, title 22, section 66265.193 requires
27 that tank systems be equipped with secondary containment in order to prevent the release of
28 hazardous waste or hazardous constituents to the environment.

1 89. On and prior to September 29, 2009, and October 7, 2009, and continuing thereafter
2 according to proof, Defendants failed to provide the necessary secondary containment in the
3 following ways:

4 (a) Defendants had no secondary containment system for the Facility's tanks and
5 ancillary systems housing EP sludge; and

6 (b) Defendants had no secondary containment for the Facility's oil treatment
7 system, including the Coalescer, Wemco, the "sludge oil" storage tank in the basement, and
8 related ancillary equipment.

9 90. Pursuant to Health and Safety Code section 25189(b), Defendants are liable for civil
10 penalties according to proof based on these intentional or negligent violations. In the alternative,
11 Defendants are strictly liable for civil penalties according to proof pursuant to Health and Safety
12 Code section 25189.2(b). Each violation of a separate provision of the HWCL and/or its
13 implementing regulations is subject to a civil penalty of up to twenty five thousand dollars
14 (\$25,000). For a continuing violation, each day a violation continues is subject to a civil penalty
15 of up to twenty five thousand dollars (\$25,000). Pursuant to Health and Safety Code section
16 25181, Defendants should also be enjoined from further violations of the HWCL.

17 **ELEVENTH CAUSE OF ACTION**

18 (Failure to Provide Adequate Secondary Containment)
19 (Cal. Code Regs., tit. 22, § 66265.196)

20 91. Paragraphs 1 through 90 above are incorporated by reference as though fully set forth
21 herein.

22 92. In relevant part, California Code of Regulations, title 22, section 66265.195 requires a
23 facility owner or operator to immediately remove from service a secondary containment system
24 from which there has been a leak or spill, or which is unfit for use.

25 93. On and prior to February 3, 2011, and continuing thereafter according to proof,
26 Defendants failed to provide adequate secondary containment for the used oil treatment system.
27 In particular, DTSC observed that the floor around the reclaim byproduct holding tank and the
28 reclaim system separator tank was cracked and damaged and also covered with oil stains.

94. Pursuant to Health and Safety Code section 25189(b), Defendants are liable for civil penalties according to proof based on these intentional or negligent violations. In the alternative, Defendants are strictly liable for civil penalties according to proof pursuant to Health and Safety Code section 25189.2(b). Each violation of a separate provision of the HWCL and/or its implementing regulations is subject to a civil penalty of up to twenty five thousand dollars (\$25,000). For a continuing violation, each day a violation continues is subject to a civil penalty of up to twenty five thousand dollars (\$25,000). Pursuant to Health and Safety Code section 25181, Defendants should also be enjoined from further violations of the HWCL.

TWELFTH CAUSE OF ACTION

(Failure to Make Waste Determination)
(Cal. Code Regs., tit. 22, §§ 66262.11 and 66260.200)

95. Paragraphs 1 through 94 above are incorporated by reference as though fully set forth herein.

96. In relevant part, California Code of Regulations, title 22, section 66262.11 requires a person who generates waste, as defined in section 66261.2, to determine if the waste is a hazardous waste using the methods specified in that regulation.

97. On and prior to September 29, 2009, October 7, 2009, and February 3, 2011, and continuing thereafter according to proof, Defendants failed to make a waste determination on the following waste as required by California Code of Regulations, title 22, section 66262.11 and 66260.200, as follows:

- (a) EP sludge from the EP sludge storage silo tank; and
- (b) used oil sludge generated from the oil treatment system that Defendants combined with debris from basement cleanups, spill cleanups from the holding tank area, and other assorted wastes, to be shipped to a landfill as nonhazardous waste.

98. Pursuant to Health and Safety Code section 25189(b), Defendants are liable for civil penalties according to proof based on these intentional or negligent violations. In the alternative, Defendants are strictly liable for civil penalties according to proof pursuant to Health and Safety Code section 25189.2(b). Each violation of a separate provision of the HWCL and/or its implementing regulations is subject to a civil penalty of up to twenty five thousand dollars

1 (\$25,000). For a continuing violation, each day a violation continues is subject to a civil penalty
2 of up to twenty five thousand dollars (\$25,000). Pursuant to Health and Safety Code section
3 25181, Defendants should also be enjoined from further violations of the HWCL.

4 **THIRTEENTH CAUSE OF ACTION**

5 (Failure to Provide Information on Waste Streams)
6 (Health & Saf. Code, § 25185.6)

7 99. Paragraphs 1 through 98 above are incorporated by reference as though fully set
8 forth herein.

9 100. In relevant part, Health and Safety Code section 25185.6 requires that, upon
10 request from the Department, owners and operators must provide any existing information
11 relating to hazardous substances, hazardous wastes, or hazardous materials.

12 101. On November 4, 2009, the Department sent an information request to Defendants
13 requesting information on each waste stream generated from the used oil treatment system at the
14 Facility.

15 102. In its response, Defendants failed to disclose that it pumped out the waste stream
16 from the Wemco (part of the used oil treatment system) into a septic tank hauler and disposed of
17 the hazardous waste off-site as a nonhazardous waste. The Department only learned of this waste
18 stream upon reviewing files in the City of Modesto's office and discovering Defendants' use of a
19 septic tank hauler.
20

21 103. Pursuant to Health and Safety Code section 25189(b), Defendants are liable for
22 civil penalties according to proof based on these intentional or negligent violations. In the
23 alternative, Defendants are strictly liable for civil penalties according to proof pursuant to Health
24 and Safety Code section 25189.2(b). Each violation of a separate provision of the HWCL and/or
25 its implementing regulations is subject to a civil penalty of up to twenty five thousand dollars
26 (\$25,000). For a continuing violation, each day a violation continues is subject to a civil penalty
27 of up to twenty five thousand dollars (\$25,000). Pursuant to Health and Safety Code section
28

1 25181, Defendants should also be enjoined from further violations of the HWCL.

2 **FOURTEENTH CAUSE OF ACTION**
3 (Failure to Manifest Hazardous Waste)
4 (Health & Saf. Code, § 25160)

5 104. Paragraphs 1 through 103 above are incorporated by reference as though fully set
6 forth herein.

7 105. In relevant part, California Health & Saf. Code, § 25160 provides that a person
8 generating hazardous waste that is transported offsite for disposal must complete a manifest prior
9 to the time the waste is transported and, within thirty days, submit to the Department a copy of
10 the manifest.

11 106. On and prior to March 1, 2012, and continuing thereafter according to proof,
12 Defendants disposed of hazardous waste at the Clean Harbors Disposal Facility in Buttonwillow,
13 California, without completing any of the required manifests or providing any manifests to the
14 Department, as required by the HWCL.

15 107. Pursuant to Health and Safety Code section 25189(b), Defendants are liable for
16 civil penalties according to proof based on these intentional or negligent violations. In the
17 alternative, Defendants are strictly liable for civil penalties according to proof pursuant to Health
18 and Safety Code section 25189.2(b). Each violation of a separate provision of the HWCL and/or
19 its implementing regulations is subject to a civil penalty of up to twenty five thousand dollars
20 (\$25,000). For a continuing violation, each day a violation continues is subject to a civil penalty
21 of up to twenty five thousand dollars (\$25,000). Pursuant to Health and Safety Code section
22 25181, Defendants should also be enjoined from further violations of the HWCL.
23
24

25 ///

26 ///

27 ///

28

1 **FIFTEENTH CAUSE OF ACTION**

2 (Failure to Notify DTSC of Fires and Explosions)
3 (Cal. Code Regs., tit. 22, §§ 66265.51 and 66265.56(i) and (j))

4 108. Paragraphs 1 through 107 above are incorporated by reference as though fully set
5 forth herein.

6 109. In relevant part, California Code of Regulations, title 22, section 66265.51(a)
7 provides that owners and operators must have a contingency plan for the Facility that is designed
8 to minimize hazards to human health or the environment from fires, amongst other events.
9

10 110. In relevant part, California Code of Regulations, title 22, section 66265.51(b)
11 provides that owners and operators must carry out the provisions of the plan immediately
12 "whenever there is a fire, explosion, or release of hazardous waste or hazardous waste
13 constituents which could threaten human health or the environment."
14

15 111. In relevant part, California Code of Regulations, title 22, section 66265.56(i)
16 provides that, after a fire or explosion, owners and operators must notify DTSC that the facility
17 has complied with explicit safety measures prior to resuming operations.

18 112. In relevant part, California Code of Regulations, title 22, section 66265.56(j)
19 provides that, within 15 days of a fire or explosion, owners and operators must submit a written
20 report to DTSC stating, amongst other things, the nature of the fire, the extent of any injuries, an
21 assessment of actual or potential hazards to human health or the environment, and an estimated
22 quantity and disposition of recovered material that resulted from the incident.
23

24 113. In 2006, 2007, 2008, 2009, and 2011, multiple fires and/or explosions occurred at
25 the Facility in areas covered by defendant's contingency plan. These incidents include:

26 (a) A fire in 2006 that Gallo Glass employees informed the Department had
27 occurred, but for which no incident report was written or filed.

28 (b) A fire in 2007 that Gallo Glass employees informed the Department had

1 occurred, but for which no incident report was written or filed.

2 (c) On or around June 8, 2008, a fire in an enclosed, five-story building
3 occurred at the Facility in a machine area when film and residue from Gallo Glass's use of
4 lubricating oil ignited. Four Gallo Glass employees were taken to the hospital for smoke
5 inhalation.
6

7 (d) On or around September 14, 2008, an explosive device, or "home made dry
8 ice bomb," detonated at the Facility, injuring a Gallo Glass employee.

9 (e) On or around August 27, 2009, a three-alarm fire ignited at the Facility in a
10 four-story incinerator area. The Facility's special hazard extinguishing system operated but failed
11 to suppress the fire. The fire caused the Facility's electric furnace to crack and leak molten glass
12 from the pot, the radiant heat from which started fires throughout the basement portion around the
13 containment walls, where Defendants stored combustibles.
14

15 (f) On or around June 13, 2011, a major fire erupted at the Facility, requiring
16 five fire engines to extinguish.

17 114. Defendants failed to adequately notify DTSC about any of these respective fires
18 and/or explosions, in violation of California Code of Regulations, title 22, sections 66265.56(i)
19 and (j).
20

21 115. Pursuant to Health and Safety Code section 25189(b), Defendants are liable for
22 civil penalties according to proof based on these intentional or negligent violations. In the
23 alternative, Defendants are strictly liable for civil penalties according to proof pursuant to Health
24 and Safety Code section 25189.2(b). Each violation of a separate provision of the HWCL and/or
25 its implementing regulations is subject to a civil penalty of up to twenty five thousand dollars
26 (\$25,000). For a continuing violation, each day a violation continues is subject to a civil penalty
27 of up to twenty five thousand dollars (\$25,000). Pursuant to Health and Safety Code section
28

1 25181, Defendants should also be enjoined from further violations of the HWCL.

2 **REQUEST FOR RELIEF**

3
4 The Department requests that the Court grant the relief that follows:

5 A. Enter judgment that Defendants have violated the HWCL and its implementing
6 regulations as set forth in the First through Fifteenth Causes of Action;

7 B. Enter judgment that Defendants are liable for civil penalties for the violations set
8 forth in the First through Fifteenth Causes of Action as authorized by Health and Safety Code
9 section 25189 or, in the alternative, by Health and Safety Code 25189.2, in an amount according
10 to proof;

11 C. Enter temporary restraining orders, preliminary injunctions, permanent injunctions, or
12 other orders enjoining Defendants, and each of them, from illegally treating, storing, and
13 disposing of hazardous waste in California and requiring Defendants to otherwise comply with
14 the HWCL and the regulations adopted thereunder;

15 D. Grant the Department its costs of suit herein; and

16 E. Grant such other and further relief as the Court deems just and proper.

17 Dated: February 27, 2015

Respectfully Submitted,

18 KAMALA D. HARRIS
19 Attorney General of California

20 

21
22 SCOTT J. LICHTIG
23 Deputy Attorney General

24 *Attorneys for* **PEOPLE OF THE STATE OF**
25 **CALIFORNIA**, ex rel., Barbara A. Lee,
26 Director of the California Department of
27 Toxic Substances Control
28

To: PALERMO Jaclyn[PALERMO.Jaclyn@deq.state.or.us]
From: McClintock, Katie
Sent: Sat 3/5/2016 3:55:30 PM
Subject: Fwd: PDFs
[healthrpdf.pdf](#)
[ATT00001.htm](#)
[uraniumstain.pdf](#)
[ATT00002.htm](#)

The second one on hazards in art may be more useful to you, but since there was uranium used at bullseye, I thought I'd send you both. Happy reading.

Sent from my iPhone

Begin forwarded message:

From: "Doyle, Liz" <Doyle.Liz@epa.gov>
Date: March 4, 2016 at 7:58:52 AM PST
To: "McClintock, Katie" <McClintock.Katie@epa.gov>
Cc: "dHondt, MaryThadia" <dHondt.MaryThadia@epa.gov>
Subject: FW: PDFs

Two articles provided to me by the Corning Museum of Glass Library that were on a list of recommended reads for this topic.

MaryThadia, you can cancel these requests if you didn't already receive them. They were on your list.

Liz Doyle, MILS

Supervisory Librarian (contractor, ASRC Primus)
U.S. EPA Region 10 Library / OMP-0102 / 1200 6th Ave, Ste 900
Seattle WA 98101-3140

doyle.liz@epa.gov

p: 206-553-2134
<http://www2.epa.gov/libraries/region-10-library-services>

To: PALERMO Jaclyn[PALERMO.Jaclyn@deq.state.or.us]
Cc: DAVIS George[DAVIS.George@deq.state.or.us]
From: McClintock, Katie
Sent: Sat 3/5/2016 6:38:32 AM
Subject: RE: glass operations in Oregon

Jaclyn and George: I am happy to help provide my understanding of the processes at Bullseye and Uroboros. The description of the facilities and processes included in this email are based on my observations during my site visits and what I have learned during communications with these companies. I am attempting to portray the facts as I know them, about the operations, and am not interpreting those facts.

●■■■■■■■■ A description of the furnaces

Bullseye and Uroboros both primarily use a furnace type called a “day tank.” These day tanks resemble larger production furnaces used in the container and float glass industries, but are much smaller. They are built on-site and are composed of several different types of refractory (brick) material. The general design is a cube with a rounded (crown) top. It is filled with glass at the bottom and gas an air or oxygen fired just above the maximum glass line. The exhaust is then vented out of a flu. When the glass is finished melting, it must be removed with a ladle. Since often these furnaces are changing color, they remove as much glass as possible before starting the next batch. If they are making the same color, they may leave a little in the bottom between melts.

Bullseye also has a few pot furnaces which are made of a solid ceramic material that sits in a refractory lined construct which heats the pot from the sides. This is a small amount of the overall production. The remainder of this discussion focuses on the day-tanks/furnaces.

The day tanks at Bullseye are primarily fired using oxygen and natural gas. There are two burners in each day tank on opposing corners. The day tanks at Uroboros use air and natural gas and some have a heat exchange (recuperator) to pre-heat the combustion air. Most have one burner. The combustion happens above the raw materials/glass and heat transfer happens through the surface of the glass, where there is also volatilization of raw materials. Off gassing from this volatilization and offgassing from chemical reactions within the glass are exhausted out the stack with the combustion gases.

Temperatures in the furnace are generally around 2500 degrees F during melting. I understand the furnaces can be dialed back slightly while glass is ladled out if the glass doesn't harden too much. After the furnace is empty, they are turned back to high in order to pre-heat the furnace back up to 2500 before charging new raw materials.

- Production schedule

For the day tanks at Bullseye and Uroboros, they melt on an approximately 24 hour schedule with 5-8 hours to add raw materials (they break up the raw materials into smaller batches and "charge" the furnace several times over this period), 6-8 hours to cook, and 6-8 hours to ladle glass out of the furnace.

My understanding is that these furnaces are kept hot for at around 350-500 melts of glass (around 24 hours per melt). Then they are cooled to ambient temperature, completely dismantled, and all of the brick is replaced before it is reheated and put back in operation. Once the furnace begins operation after a re-bricking, the furnace is always kept above 2000 F and are constantly firing natural gas and air (or oxygen). These furnaces are never cooled to ambient temperatures if they are not being re-bricked. For the most part the furnaces melt batches of glass sequentially, with only a brief reheat period from the lower temperatures at the end of a batch (2200 F or so) back up near 2500 F. However, the furnaces can be idled down to 2000 F as well if they are not needed to melt glass.

Each business may have a slightly different operating schedule. My understanding is that Bullseye melts glass from Sunday mid-day to Friday evening. Uroboros operates about 4 consecutive days per week (M-Th, or T-F). Furnaces can idle at other times (meaning sitting empty but at least 2000 F), because of holidays, economy, or desire to coordinate furnace schedules so their products can be mixed.

- A description of the overall process

At both facilities they mix their own recipes of glass, which contains basic ingredients like sand and smaller ingredients like metal oxides (for color and glass quality). They then mix these ingredients together and then add them to the furnace over a period of 5-8 hours. Once the glass is done cooking, workers hand ladle the glass out and roll it into flat sheets. These flat sheets are

then coated (if necessary), and put through an annealing lehr to control the cooling so the glass doesn't fracture. The glass sheets are then trimmed and packed for shipping to customers (or sale in house). The trimmings can be re-melted in future batches or can be crushed to sell as a product called "frit."

- Anything else you think we should know about the glass manufacturing process

There is nothing else that I can think of right now. Please let me know if you have any other questions or if you would like more information about the process overview I included here.

Katie McClintock

Air Enforcement Officer

EPA Region 10

1200 Sixth Avenue, Suite 900, OCE-101

Seattle, WA 98101

Phone: 206-553-2143

Fax: 206-553-4743

Mcclintock.katie@epa.gov

From: PALERMO Jaclyn [mailto:PALERMO.Jaclyn@deq.state.or.us]

Sent: Thursday, March 03, 2016 9:52 AM

To: McClintock, Katie <McClintock.Katie@epa.gov>

Cc: DAVIS George <DAVIS.George@deq.state.or.us>

Subject: glass operations in Oregon

Katie,

As I understood, EPA recently went on site visits to glass manufacturing facilities in Oregon. George Davis also attended the visits but is really busy working on various tasks and I am unable to get the facility operations process description. Since you have familiarity, can you help describe the process and glass manufacturing operations? Here are a few things that would be useful to know:

- ☐ ☐ ☐ ☐ ☐ ☐ A description of the furnaces
- ☐ ☐ ☐ ☐ ☐ ☐ Production schedule
- ☐ ☐ ☐ ☐ ☐ ☐ A description of the overall process
- ☐ ☐ ☐ ☐ ☐ ☐ Anything else you think we should know about the glass manufacturing process

Thank you,

Jaclyn M. Palermo

Air Program Operations Section Manager

Oregon Department of Environmental Quality

811 SW Sixth Avenue

Portland, OR 97204

Tel: 503-229-6491

To: Shelow, David[Shelow.David@epa.gov]; Landis, Matthew[Landis.Matthew@epa.gov]
From: McClintock, Katie
Sent: Sat 3/5/2016 6:18:53 AM
Subject: FW: Portland glass facilities
Summary of Conversation with Geoff Donovan of USFS Moss Researcher_MSL.docx

Hi Matt and Dave –

I'm the point person for this project in Region 10 (and somewhat EPA) on the technical side. Your email was forwarded to me. Looks like you had a great technical call with Geoffrey yesterday. I am posting your notes for this call on our onedrive for this project. Please let me know if that isn't okay and I will remove it. I am granting you both access to the onedrive in case you need it. Let me know if you would also like to receive my daily update emails (which are posted on the onedrive each night).

Thanks.

Katie

From: Koerber, Mike
Sent: Friday, March 04, 2016 10:12 AM
To: Hastings, Janis <Hastings.Janis@epa.gov>; Bray, Dave <Bray.Dave@epa.gov>
Cc: McClintock, Katie <McClintock.Katie@epa.gov>
Subject: FW: Portland glass facilities

As a followup to today's call, here is the summary of the call with USFS.

Mike

From: Shelow, David
Sent: Friday, March 04, 2016 12:29 PM
To: Wayland, Richard <Wayland.Richard@epa.gov>; Fox, Tyler <Fox.Tyler@epa.gov>;

Benedict, Kristen <Benedict.Kristen@epa.gov>; Weinstock, Lewis
<Weinstock.Lewis@epa.gov>; Koerber, Mike <Koerber.Mike@epa.gov>
Cc: Watkins, Tim <Watkins.Tim@epa.gov>; Johnson, Steffan <johnson.steffan@epa.gov>;
Hemby, James <Hemby.James@epa.gov>; Landis, Matthew <Landis.Matthew@epa.gov>
Subject: RE: Portland glass facilities

Here are the notes from our call with the researcher Geoff Donovan.

Dave and Matt.

David M. Shelow
National Air Toxics Ambient Monitoring Program Manager
U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Ambient Air Monitoring Group C304-06
Research Triangle Park, NC 27711
Phone: 919-541-3776
Fax: 919-541-1903
Email: shelow.david@epa.gov

From: Wayland, Richard
Sent: Wednesday, March 02, 2016 3:14 PM
To: Fox, Tyler <Fox.Tyler@epa.gov>; Benedict, Kristen <Benedict.Kristen@epa.gov>;
Weinstock, Lewis <Weinstock.Lewis@epa.gov>
Cc: Watkins, Tim <Watkins.Tim@epa.gov>; Shelow, David <Shelow.David@epa.gov>;
Johnson, Steffan <johnson.steffan@epa.gov>; Hemby, James <Hemby.James@epa.gov>
Subject: FW: Portland glass facilities

Hi folks,

In the attached memo, Janet outlines several actions being undertaken by EPA in response to the Portland Bullseye Glass air toxics issue. Specifically, there are 3 things that we (AQAD) are responsible for tracking.

1. Improving our characterization of emissions from art glass manufacturing facilities
2. Asses the viability of the original USFS study (Moss monitoring) as a screening methodology for air toxics
3. Review screening modeling by Puget Sound

Mike Koerber has asked for a short paragraph on each of these 3 activities by early next week. On the Moss monitoring, I have not heard from the USFS scientist and am cc'ing Tim Watkins to see if the fellow has contacted him yet. On the other two, can you guys help me pull a paragraph together to get back to Mike? Maybe try for a draft by Friday and we can finalize it next week.

Thanks

Chet

Richard A. "Chet" Wayland | Director | Air Quality Assessment Division - Mail Code C304-02 | Office of Air Quality Planning & Standards | U.S. Environmental Protection Agency | Research Triangle Park, NC 27711 | Desk: 919-541-4603 | Cell: 919-606-0548 | Fax: 919-541-4511 |

Summary of Phone Conversation with USFS Moss Researcher Geoff Donovan

David Shelow OAQPS and Matthew Landis, PhD ORD

We talked with Geoff Donovan Thursday March 3, 2016 about his research work on moss in Portland OR. Their paper is currently in review at a peer reviewed scientific journal and has not yet been released. Mr. Donovan indicated that he would send us a courtesy copy of the paper on Monday, to review. From our conversation we gleaned that their research consisted of sampling epiphytic moss from trees approximately 1 meter off the ground in a 1 x 1 kilometer grid sampling domain in Portland OR. Epiphytic species derive all their nutrients from the atmosphere and are generally thought to be good indicators of atmospheric deposition. Mr. Donovan indicated that they would have preferred to sample epiphytic lichens but they were not present in certain areas of their sampling domain. Therefore, they selected a species of epiphytic moss that are ubiquitous in that Region. They took 346 moss samples and had them digested and analyzed at a commercial laboratory to see if there was evidence of bioaccumulation of air toxins. They performed ICPMS for metals and GC/MS analysis for PAHs. They performed some spatial regression analysis models to determine hotspots of cadmium and a variety of other metals (arsenic, selenium, chromium, cobalt, nickel, lead). After they saw their initial results they went back and collected an additional 25 samples near the Bullseye Glass facility. They compared this data to OR DEQ monitoring data and found there was a good correlation.

In Dr. Landis's professional opinion, from our initial conversation and previous work in the scientific literature, this is a viable qualitative screening method for ambient air toxins. Particularly if done in this manner in which they cover a large area with many samples then plotting concentration and distances. Commercially available mapping software (e.g., Golden Software Surfer, ArcGIS) can be used to spatially interpolate moss concentration to highlight potential hotspots where more quantitative active ambient sampling techniques can investigate these preliminary screening results. Matt has done similar work in the Oil Sands region in Canada studying the bioaccumulation of metals in epiphytic lichens ¹ (references below). One of Geoff's coauthors, Sarah Jovan, of this study has done similar work with lichens. Since the paper is still in review, and we not yet been able to evaluate their sampling, analytical, or data analysis methods we are reserving final judgement pending its availability.

The main issue we need to follow-up on is the validity of their reported arsenic concentrations. Matt pointed out to Mr. Donovan that he ran into issues with arsenic artifacts in his biological lichen sample matrix when analyzing using a conventional quadrupole ICPMS instrument due to potassium related polyatomic interferences (Edgerton et al). Geoff indicated that he thought that was the type of instrument used by the commercial laboratory that analyzed their moss samples, but he pointed out that his coauthor Sarah would be able to clarify. During the Oil Sands work, Matt identified the arsenic interference problem when conducting QA/QC analysis of lichen sample extracts on the EPA NERL high resolution magnetic sector field ICPMS. He observed unusually high and variable arsenic concentrations from a conventional DRC-ICPMS looking at the ⁷⁵As isotope in comparison to the EPA HR-ICPMS ⁷⁵As isotope. The HR-ICPMS is able to resolve the analyte isotope from polyatomic interferences with the same atomic mass using kinetic energy differences. They ultimately overcame the issue on the DRC-ICPMS by quantifying arsenic as arsenic oxide (AsO) which subsequently compared extremely well with the HR-ICPMS ⁷⁵As results.

In summary, we will remain in contact with Geoff Donovan and coauthors to provide assistance if requested. Matt asked if they conducted receptor modeling (e.g., positive matrix factorization, Unmix)

on their data to help identify sources. Mr. Donovan responded that they had not, but that they may be interested in collaborating on that in the future. Matt also indicated that NERL may be able to run some of their sample extracts on their HR-ICPMS to evaluate in the arsenic results are affected by positive polyatomic artifacts.

References:

Landis, M.S.; Pancras, J.P.; Graney, J.R.; Stevens, R.K.; Percy, K.E.; Krupa, S (2012). Receptor Modeling of Epiphytic Lichens to Elucidate the Sources and Spatial Distribution of Inorganic Air Pollution in the Athabasca Oil Sands Region. In *Alberta Oil Sands: Energy, Industry and the Environment*. Kevin Percy ed., Elsevier, Oxford, England.

Graney, J.R.; Landis, M.S.; Krupa, S (2012). Coupling lead isotopes and element concentrations in epiphytic lichens to track processes sources of air emissions in the Athabasca Oil Sands Region. In *Alberta Oil Sands: Energy, Industry and the Environment*. Kevin Percy ed., Elsevier, Oxford, England.

Blum, J.D.; Johnson, M.W.; Gleason, J.D.; Demers, J.D.; Landis, M.S.; Krupa, S. (2012). Mercury concentration and isotopic composition of epiphytic tree lichens in the Alberta Oil Sands Region. In *Alberta Oil Sands: Energy, Industry and the Environment*. Kevin Percy ed., Elsevier, Oxford, England.

Edgerton, E.S.; Fort, J.M.; Baumann, K.; Graney, J.R.; Landis, M.S.; Berryman, S.; Krupa, S. (2012). Method for Extraction and Multi-element Analysis of *Hypogymnia Physodes* Samples from the Athabasca Oil Sands Region. In *Alberta Oil Sands: Energy, Industry and the Environment*. Kevin Percy ed., Elsevier, Oxford, England.

You can access and download the actual chapters from Matt's Researchgate page:

ResearchGate Home Page: https://www.researchgate.net/profile/Matthew_Landis

Click on the contributions tab and go back to 2012.

To: Steve Van Slyke[SteveV@psc Clean Air.org]
Cc: Narvaez, Madonna[Narvaez.Madonna@epa.gov]
From: McClintock, Katie
Sent: Sat 3/5/2016 6:03:57 AM
Subject: RE: Toxic Emissions from Art Glass Facilities

Thanks for sending Steve. And especially thanks for coming to our meeting today and being an active participant. I thought it was a great discussion overall.

This is an email we prepared for outreach to our states to bring them up to speed on this glass issue as ask for your participation in investigating sources. Madonna is coordinating our response (yes we still have to respond). Our process is different since you are in the thick of it already. I'm not sure why it came to you from Region 9, but oh well.

3 sources we are thinking about going to or having you go to (if you are interested) are Momka's Glass in Arlington, WA; Glassy Baby in Seattle, WA; and Fremont Antique Glass, in Seattle, WA. Brian also mentioned another place in Fremont you found. Let me know your level of interest in checking these guys out.

Thanks.

From: Steve Van Slyke [mailto:SteveV@psc Clean Air.org]
Sent: Friday, March 04, 2016 11:18 AM
To: McClintock, Katie <McClintock.Katie@epa.gov>
Subject: Fwd: Toxic Emissions from Art Glass Facilities

Sent from my Verizon Wireless 4G LTE smartphone

----- Original message -----

From: Erik Saganić <ErikS@pscleanair.org>
Date: 03/04/2016 10:13 AM (GMT-08:00)
To: Carole Cenci <CaroleC@pscleanair.org>, Steve Van Slyke <SteveV@pscleanair.org>
Cc: Kathy Strange <KathyS@pscleanair.org>, Brian Renninger <BrianR@pscleanair.org>, Joanne Todd <JoanneT@pscleanair.org>
Subject: FW: Toxic Emissions from Art Glass Facilities

I got bcc'd on this, so you all likely got it too, but FYI in case:

From: BANDROWSKI, MIKE [<mailto:Bandrowski.Mike@epa.gov>]
Sent: Friday, March 04, 2016 10:00 AM
Subject: Toxic Emissions from Art Glass Facilities

An issue associated with toxic emissions from art glass facilities has been identified (see background below) and we want to make you aware of this issue.

High levels of air toxics were monitored in the air near two art glass manufacturing facilities in Portland, Oregon. The EPA has been working closely with Oregon officials to further understand the emissions and the risk to the public, if any and to work to reduce any risk to the public. As a precaution, the EPA is gathering information to better understand similar art glass manufacturing plants across the country – e.g., locations, air emissions, pollution controls, business operations, etc. Our current information indicates that there are fewer than 20 art glass manufacturing plants nationwide with significant emissions levels. Further understanding of these facilities will inform what actions we take to ensure compliance with existing regulations as well as to review and, if necessary, revise the current federal emission standards to ensure these plants operate in an environmentally safe manner.

While EPA is looking into this issue, we also want to alert our state, local, and tribal partners. If you know of facilities that meet the following criteria, please let us know.

- The art, architectural, or colored glass manufacturing facilities of concern are those who melt raw materials (metals) to make their glass, this gives them more control over the colors produced. The facilities would have large distribution of their products.
- Those who are hobby and crafts glass blowers typically buy colored glass to melt down for their projects and due to its small size, are not part of the inquiries at this time.
- EPA is looking for facilities with uncontrolled furnace emissions.
- Arsenic and cadmium are of concern, but so is hexavalent chrome...in fact, chrome+3 *may* convert to chrome+6 in the presence of manganese and high heat.

Background

The U.S. Forest Service (USFS), in a pilot study, found moss collected from manufacturers in the Portland area—and Bullseye Glass in particular—had higher levels of heavy metals than other areas in the city. This result prompted the Oregon Department of Environmental Quality (ODEQ) to set up air monitoring systems near the Bullseye Glass facility to collect samples every few days over a 30-day period in October 2015.

In early February, ODEQ made publicly available the results of that air monitoring. The results showed elevated levels of cadmium and arsenic in the air and began investigating potential sources. The results suggest that the metals found in the monitoring were coming in large part from a glass manufacturing facility. Elevated cadmium levels were also found near another glass manufacturer, Uroboros Glass. Both companies have suspended their operations.

cadmium; Bullseye, which also used arsenic, has suspended its use. ODOregon
<http://www.deq.state.or.us/nwr/docs/metalsem/FSDEQAdressingAirTox>
regular updates and technical information on the Portland Metals website
<http://www.deq.state.or.us/nwr/metalsemissions.htm>.

OAQPS has identified 14 other similar facilities, which, like Bullseye are
art glass and may use raw metals in their processes. A Clean Air Act National
Hazardous Air Pollutants (NESHAP) (40 CFR Part 63, Subpart SSSSSS
sources has been in effect since 2007. This rule applies to continuous fu
nore of glass per year using any amount of toxic metals in the glass recip

Mike Bandrowski | Manager, Office of Air Toxics, Radiation and Indoor Air

U.S. Environmental Protection Agency | Region 9 | Air Division, Air-6 | 75 Hawthorne St |

San Francisco, CA 94105 | Tel 415.947-4194 | bandrowski.mike@epa.gov

To: Hastings, Janis[Hastings.Janis@epa.gov]
From: McClintock, Katie
Sent: Sat 3/5/2016 4:16:42 AM
Subject: Fwd: Toxic Emissions from Art Glass Facilities

Steve van Slyke showed me this email in our meeting today. Comes from region 9. It is the same general text going around but it seemed odd that region 9 was distributing to our state. I also thought region 3 was lead.

Also as a heads up we used our time in our enforcement partners meeting to bring the folks up to speed on glass. Mostly r10 agencies were present and often with permitting and enforcement. I don't know if other sources will come up, but good to have them up to speed!

Have a good weekend.

Katie

Sent from my iPhone

Begin forwarded message:

From: Steve Van Slyke <SteveV@pscleanair.org>
Date: March 4, 2016 at 11:18:17 AM PST
To: Katie McClintock <mcclintock.katie@epa.gov>
Subject: Fwd: Toxic Emissions from Art Glass Facilities

Sent from my Verizon Wireless 4G LTE smartphone

----- Original message -----

From: Erik Saganić <ErikS@pscleanair.org>
Date: 03/04/2016 10:13 AM (GMT-08:00)
To: Carole Cenci <CaroleC@pscleanair.org>, Steve Van Slyke <SteveV@pscleanair.org>
Cc: Kathy Strange <KathyS@pscleanair.org>, Brian Renninger <BrianR@pscleanair.org>, Joanne Todd <JoanneT@pscleanair.org>
Subject: FW: Toxic Emissions from Art Glass Facilities

I got bcc'd on this, so you all likely got it too, but FYI in case:

From: BANDROWSKI, MIKE [<mailto:Bandrowski.Mike@epa.gov>]
Sent: Friday, March 04, 2016 10:00 AM
Subject: Toxic Emissions from Art Glass Facilities

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High levels of air toxics were monitored in the air near two art glass manufacturing facilities in Portland, Oregon. The EPA has been working closely with Oregon officials to further understand the emissions and the risk to the public, if any and to work to reduce any risk to the public. As a precaution, the EPA is gathering information to better understand similar art glass manufacturing plants across the country – e.g., locations, air emissions, pollution controls, business operations, etc. Our current information indicates that there are fewer than 20 art glass manufacturing plants nationwide with significant emissions levels. Further understanding of these facilities will inform what actions we take to ensure compliance with existing regulations as well as to review and, if necessary, revise the current federal emission standards to ensure these plants operate in an environmentally safe manner.

While EPA is looking into this issue, we also want to alert our state, local, and tribal partners. If you know of facilities that meet the following criteria, please let us know.

- The art, architectural, or colored glass manufacturing facilities of concern are those who melt raw materials (metals) to make their glass, this gives them more control over the colors produced. The facilities would have large distribution of their products.
- Those who are hobby and crafts glass blowers typically buy colored glass to melt down for their projects and due to its small size, are not part of the inquiries at this time.

- EPA is looking for facilities with uncontrolled furnace emissions.
- Arsenic and cadmium are of concern, but so is hexavalent chrome...in fact, chrome+3 *may* convert to chrome+6 in the presence of manganese and high heat.

Background

The U.S. Forest Service (USFS), in a pilot study, found moss collected from manufacturers in the Portland area—and Bullseye Glass in particular—had higher levels of heavy metals than other areas in the city. This result prompted the Oregon Department of Environmental Quality (ODEQ) to set up air monitoring systems near Bullseye Glass and collect samples every few days over a 30-day period in October 2015.

In early February, ODEQ made publicly available the results of that air monitoring. The results showed elevated levels of cadmium and arsenic in the air and began investigating potential sources. The results suggest that the metals found in the monitoring were coming in large part from a nearby glass manufacturing facility. Elevated cadmium levels were also found near another glass manufacturer, Uroboros Glass. Both companies have suspended operations.

cadmium; Bullseye, which also used arsenic, has suspended its use. O
<http://www.deq.state.or.us/nwr/docs/metalsem/FSDEQAdressingAirTo>
regular updates and technical information on the Portland Metals webs
<http://www.deq.state.or.us/nwr/metalsemissions.htm>.

OAQPS has identified 14 other similar facilities, which, like Bullseye
art glass and may use raw metals in their processes. A Clean Air Act N
Hazardous Air Pollutants (NESHAP) (40 CFR Part 63, Subpart SSSSS
sources has been in effect since 2007. This rule applies to continuous f
nore of glass per year using any amount of toxic metals in the glass rec

Mike Bandrowski | Manager, Office of Air Toxics, Radiation and Indoor Air

U.S. Environmental Protection Agency | Region 9 | Air Division, Air-6 | 75 Hawthorne St |

San Francisco, CA 94105 | Tel 415.947-4194 | bandrowski.mike@epa.gov

To: Elleman, Robert[Elleman.Robert@epa.gov]
From: McClintock, Katie
Sent: Sat 3/5/2016 12:44:58 AM
Subject: Fwd: Portland SE Results.xlsx
[Portland SE Results.xlsx](#)
[ATT00001.htm](#)

Fresh in and not released but thought you might find it interesting to look at these results specially with respect to bullseye and hear what conclusions you draw. Levels have dropped off substantially compared to October with no large spikes.

Sent from my iPhone

Begin forwarded message:

From: "Wroble, Julie" <Wroble.Julie@epa.gov>
Date: March 4, 2016 at 4:35:01 PM PST
To: "McClintock, Katie" <McClintock.Katie@epa.gov>
Subject: FW: Portland SE Results.xlsx

Hex chrome exceeds 1E-06, but not 1E-05 risk level. Levels have dropped so maybe prior process was to blame?

Looking forward to digesting later.

From: BORISENKO Aaron [<mailto:BORISENKO.Aaron@deq.state.or.us>]
Sent: Friday, March 04, 2016 4:21 PM
To: Wroble, Julie <Wroble.Julie@epa.gov>
Subject: Portland SE Results.xlsx

Here you go. Aaron

Sampled	Sample Type	Arsenic, Total (ng/m ³ LTP)	Beryllium, Total (ng/m ³ LTP)
2/9/16 6:00	12 Hr	0.319	<0.008
2/10/16 6:00	12 Hr	1.38	0.024
2/11/16 0:00	24 Hr	1.29	<0.004
2/12/16 6:00	12 Hr	1.39	<0.008
2/13/16 0:00	24 Hr	0.683	<0.004
2/15/16 6:00	12 Hr	0.367	0.019
2/16/16 6:00	12 Hr	1.21	<0.008
2/17/16 6:00	12 Hr	0.81	<0.008

Cadmium, Total (ng/m ³ LTP)	Chromium, Total (ng/m ³ LTP)	Cobalt, Total (ng/m ³ LTP)
<0.068	<2.13	0.06
1.56	3.26	1.15
0.531	1.64	0.282
0.507	<2.13	0.319
0.311	<1.06	0.058
<0.068	<2.13	0.475
0.709	<2.13	0.202
0.585	<2.13	0.249

Hexavalent Chromium Cr(VI) (ng/m ³ LTP)	Lead, Total (ng/m ³ LTP)	Manganese, Total (ng/m ³ LTP)
Not sampled	1.34	2.96
Not sampled	3.98	29
0.139	4.24	4.39
0.156	2.66	5.75
<0.035	0.737	2.18
0.122	1.56	19.8
0.454	17.5	8.88
0.199	7.43	13.4

Nickel, Total (ng/m ³ LTP)	Selenium, Total (ng/m ³ LTP)
<0.773	0.119
6.53	2.54
3	0.73
4.36	0.103
0.751	0.163
<0.773	<0.068
2.15	1.72
3.11	0.862

Sampled	Sample Type	Arsenic, Total (ng/m ³ LTP)	Beryllium, Total (ng/m ³ LTP)
2/13/16 0:00	24 Hr	0.814	<0.004
2/16/16 6:00	12 Hr	0.495	<0.008
2/17/16 6:00	12 Hr	1.22	<0.008

Cadmium, Total (ng/m ³ LTP)	Chromium, Total (ng/m ³ LTP)	Cobalt, Total (ng/m ³ LTP)
0.317	<1.06	0.056
0.501	<2.13	0.15
1.06	3.16	0.28

Hexavalent Chromium Cr(VI) (ng/m ³ LTP)	Lead, Total (ng/m ³ LTP)	Manganese, Total (ng/m ³ LTP)
Not Sampled	1.62	1.99
Not Sampled	3.17	7.38
0.501	27.5	13.4

Nickel, Total (ng/m ³ LTP)	Selenium, Total (ng/m ³ LTP)
0.809	0.254
2.43	0.239
3.5	3.56

Sampled	Sample Type	Arsenic, Total (ng/m ³ LTP)	Beryllium, Total (ng/m ³ LTP)
2/17/16 6:00	12 Hr	0.666	<0.008

Cadmium, Total (ng/m ³ LTP)	Chromium, Total (ng/m ³ LTP)	Cobalt, Total (ng/m ³ LTP)
0.277	<2.13	0.193

Hexavalent Chromium Cr(VI) (ng/m ³ LTP)	Lead, Total (ng/m ³ LTP)	Manganese, Total (ng/m ³ LTP)
Not Sampled	3.41	10.6

Nickel, Total (ng/m ³ LTP)	Selenium, Total (ng/m ³ LTP)
2.5	0.465

Sampled	Sample Type	Arsenic, Total (ng/m ³ LTP)	Beryllium, Total (ng/m ³ LTP)
2/16/16 6:00	12 Hr	1.85	<0.008

Cadmium, Total (ng/m ³ LTP)	Chromium, Total (ng/m ³ LTP)	Cobalt, Total (ng/m ³ LTP)
1.05	2.14	0.265

Hexavalent Chromium Cr(VI) (ng/m ³ LTP)	Lead, Total (ng/m ³ LTP)	Manganese, Total (ng/m ³ LTP)
Not Sampled	40.5	8.24

Nickel, Total (ng/m ³ LTP)	Selenium, Total (ng/m ³ LTP)
2.03	0.734

To: Brian Renninger[BrianR@pscleanair.org]
From: McClintock, Katie
Sent: Fri 3/4/2016 7:19:06 PM
Subject: Re: Next Week Spectrum Glass

Momka's glass. Arlington

Sent from my iPhone

On Feb 16, 2016, at 8:17 AM, Brian Renninger <BrianR@pscleanair.org> wrote:

We don't know much about Fremont Antique Glass. It is not a registered source with us.

Google gives an address for Fremont Antique Glass as 3614 2nd Ave NW. We have another registered source at that address, Savage Color, which has a permit for lithographic offset printing.

I won't be able to go on a visit there today. I am scrambling a bit to get caught up for doing tomorrow's inspection.

Brian Renninger, P.E.

Engineer

Puget Sound Clean Air Agency

206.689.4077

brianr@pscleanair.org

1904 Third Avenue, Suite 105

Seattle, WA 98101

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www.pscleanair.org

From: McClintock, Katie [<mailto:McClintock.Katie@epa.gov>]

Sent: Monday, February 15, 2016 7:58 PM

To: John Schantz; Brian Renninger; Steve Van Slyke

Cc: Hedgpeth, Zach; Downey, Scott

Subject: RE: Next Week Spectrum Glass

Have you guys ever looked at Fremont Antique Glass. We thought about popping over there soon (maybe even Tuesday) to see what their operation looks like and the magnitude to see if smaller companies might raise similar issues. Would you or someone at PSCAA be interested in going?

From: John Schantz [<mailto:JohnS@pscleanair.org>]

Sent: Friday, February 12, 2016 3:22 PM

To: McClintock, Katie <McClintock.Katie@epa.gov>; Brian Renninger <BrianR@pscleanair.org>

Cc: Hedgpeth, Zach <Hedgpeth.Zach@epa.gov>

Subject: RE: Next Week Spectrum Glass

Hi Katie- I'm also looking forward to visiting Spectrum on Wednesday. I'm booked up on Tuesday morning, so I'm hoping we can schedule the chat for early afternoon.

Thanks- John

From: McClintock, Katie [<mailto:McClintock.Katie@epa.gov>]

Sent: Friday, February 12, 2016 3:08 PM

To: Brian Renninger

Cc: Hedgpeth, Zach; John Schantz

Subject: RE: Next Week Spectrum Glass

Great. Look forward to it. I'll set up a time on Tuesday for us to chat for 30 minutes to make sure we are on the same page before the inspection Wednesday at 9:30 am.

From: Brian Renninger [<mailto:BrianR@pscleanair.org>]
Sent: Friday, February 12, 2016 3:07 PM
To: McClintock, Katie <McClintock.Katie@epa.gov>
Cc: Hedgpeth, Zach <Hedgpeth.Zach@epa.gov>; John Schantz <JohnS@pscleanair.org>
Subject: Next Week Spectrum Glass

I spoke with the Agency Inspector John Schantz and he is up for an inspection on Wednesday. He will also be in the office on Tuesday if you would like to meet or have a telephone call I'm free all day Tuesday except between 3 and 4 pm?

I have also attached the Agency Evaluation Report for the facility. This is what an inspector would have with them during an inspection. It lists: identifying information; required safety equipment; brief summaries of recent inspections and recent NOVs; lists each active Order of Approval and their conditions; and has a list of equipment for the facility. It might be useful for familiarizing yourself with the facility.

Sincerely,

Brian Renninger, P.E.

Engineer

Puget Sound Clean Air Agency

206.689.4077

brianr@pscleanair.org

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Seattle, WA 98101

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To: Elleman, Robert[Elleman.Robert@epa.gov]
From: McClintock, Katie
Sent: Fri 3/4/2016 5:26:06 AM
Subject: RE: a question about your CBI data

Yes, they should talk to Greg Grunow or George Davis. They have access to two days of records that would be useful to compare to ambient records.

From: Elleman, Robert
Sent: Thursday, March 03, 2016 5:58 PM
To: McClintock, Katie <McClintock.Katie@epa.gov>
Subject: RE: a question about your CBI data

Thanks. I read the sampling report in more detail. ODEQ is going to be measuring PM10, just like they have been. And they will have met data from the Reed College site and also from a site just to the SW of Bullseye. I'm concerned about the representativeness of that new site too, although having it to compare to Reed College is helpful. I'd advocate for a site in the Fred Meyer parking lot since it is quite free of obstacles to mess with the wind.

As for the Italy article, my main question would be whether their emissions are combustion related (PM2.5) or mechanical (PM10). It makes a big difference for fallout. Their monitors were more downwind from the emissions source than we have here in Bullseye. They measured both air concentration and deposition rate. I didn't see that ODEQ was going to measure deposition rate. I know ODEQ is testing soils....

From: McClintock, Katie
Sent: Thursday, March 03, 2016 5:44 PM
To: Elleman, Robert <Elleman.Robert@epa.gov>
Subject: Re: a question about your CBI data

I can't remember. I'll check tonight. They got a limited amount of data.

Sent from my iPhone

On Mar 3, 2016, at 5:37 PM, Elleman, Robert <Elleman.Robert@epa.gov> wrote:

Katie,

Would DEQ already have that CBI data? Should I direct Phil Allen at DEQ to talk to someone in particular at his agency to get the data? He will need it to interpret his modeling results, or at a minimum for me and him to interpret the met analysis?

Thanks,

Rob

Robert Elleman

Meteorologist

EPA Region 10, Seattle

(206) 553-1531

elleman.robert@epa.gov

To: INAHARA Jill[INAHARA.Jill@deq.state.or.us]
From: McClintock, Katie
Sent: Thur 3/3/2016 11:19:38 PM
Subject: RE: baghouse on glass furnace?

I'm sorry I didn't response to this. I just was reading through company records and my memory was jogged that this came in while I was on a call earlier.

I have some stack test data from Spectrum that was submitted to Puget Sound (and therefore public) but it is not speciated for metals. I will send that along in a separate email with the description from the permit writer on the test method. This unfortunately doesn't tell you how well it is working for metals specifically, but my observations on site were that the baghouse is likely collecting at least some of the metals.

They claimed everything CBI so for the moment, I can't share much more. However, even with data, the tricky part is that stained glass making is variable (reds some days, greens another, etc) so data on stack tests or dust fines is only going to be representative of a short period of time. We need a bigger picture approach, which I am also working on.

Let me know if you have further questions and we can talk more on the phone as well if that is easier.

Katie McClintock

Air Enforcement Officer

EPA Region 10

1200 Sixth Avenue, Suite 900, OCE-101

Seattle, WA 98101

Phone: 206-553-2143

Fax: 206-553-4743

Mcclintock.katie@epa.gov

From: INAHARA Jill [<mailto:INAHARA.Jill@deq.state.or.us>]
Sent: Thursday, March 03, 2016 8:50 AM
To: McClintock, Katie <McClintock.Katie@epa.gov>
Subject: RE: baghouse on glass furnace?

I assume it works well? Any test data? I think I already know the answer to that one.

Thanks, Katie!

From: McClintock, Katie [<mailto:McClintock.Katie@epa.gov>]
Sent: Thursday, March 03, 2016 8:48 AM
To: INAHARA Jill
Subject: RE: baghouse on glass furnace?

Spectrum Glass in Woodinville, Washington. Let me know if you have more questions.

From: INAHARA Jill [<mailto:INAHARA.Jill@deq.state.or.us>]
Sent: Thursday, March 03, 2016 8:46 AM
To: McClintock, Katie <McClintock.Katie@epa.gov>
Subject: baghouse on glass furnace?

Hi Katie,

Can you please tell me the name of the company that has a baghouse installed on a stained-glass furnace? And where it is located? I'm putting together some talking points.

Thanks!

Jill

To: INAHARA Jill[INAHARA.Jill@deq.state.or.us]
From: McClintock, Katie
Sent: Thur 3/3/2016 11:13:33 PM
Subject: FW: Spectrum Glass Test Report
[Spectrum Test Report 11-24-03.pdf](#)
[RES540.pdf](#)

From: Brian Renninger [mailto:BrianR@psccleanair.org]
Sent: Thursday, February 18, 2016 10:58 AM
To: McClintock, Katie <McClintock.Katie@epa.gov>; Hedgpeth, Zach <Hedgpeth.Zach@epa.gov>; owens.katherine@epamail.epa.gov
Subject: Spectrum Glass Test Report

Attached is a copy of the Spectrum Glass Emissions Test from 11-24-03.

Interesting thing about this test. From the details in Appendix A, it appears they used PSCAA method 5 (see attached board resolution for the method) which has EPA method 5 front half, plus addition procedures for measuring back half from the impingers. From just a quick scan it appears that the test firm used the total particulate result to calculate the g/kg value for demonstration with the Subpart CC limit rather than the front half only which would be more in line with the NSPS wording (which refers to using 60.8 and 40 CFR 60 Appendix A test methods).

Upshot, it still demonstrates compliance with the NSPS particulate limit but, does have some condensable information in there as well.

Brian Renninger, P.E.

Engineer

Puget Sound Clean Air Agency

206.689.4077

brianr@pscleanair.org

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Seattle, WA 98101

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RESOLUTION NO. 540

RESOLUTION OF THE BOARD OF DIRECTORS
OF THE PUGET SOUND AIR POLLUTION
CONTROL AGENCY ADOPTING MODIFIED
PARTICULATE SOURCE TEST PROCEDURES

WHEREAS, Regulation I Section 9.09(f) requires procedures for source sampling performed in connection with standards of Regulation I and II for particulate and gases to be done using current Environmental Protection Agency requirements or procedures and definitions adopted by the Board; and

WHEREAS, to conform to current safe and less toxic chemical storage, the particulate measurement procedures currently used by the Agency have been proposed for modification; and

WHEREAS, the Expanded Advisory Council reviewed and approved said source test laboratory procedure modifications; and

WHEREAS, a public hearing was held by the Puget Sound Air Pollution Control Agency Board of Directors on August 11, 1983, to allow public input and critique on the proposal; and

WHEREAS, the Board deems it necessary to adopt said modification to source test procedures; now therefore,

BE IT RESOLVED BY THE BOARD OF PUGET SOUND AIR POLLUTION CONTROL AGENCY:


The Board of Directors does hereby adopt the modifications to the source test procedures, a copy of which is attached hereto and made a part hereof.

PASSED AND APPROVED by the Board of Directors of the Puget Sound Air Pollution Control Agency held this 11th day of August, 1983.

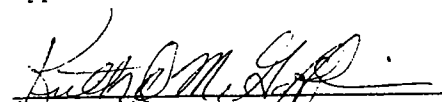
PUGET SOUND AIR POLLUTION CONTROL AGENCY

By 
Chairman

Attest:


Air Pollution Control Officer

Approved as to form:


Agency Attorney

Proposed Revised PSAPCA
Particulate Source Test Procedures

Engineering Division
Puget Sound Air Pollution Control Agency
200 West Mercer Street, Room 205
P.O. Box 9863
Seattle, Washington 98109

June 9, 1983

I. Procedures for Particulate Source Sampling

Unless otherwise authorized by the Control Officer, all particulate source sampling performed to demonstrate compliance with the emission standards of Regulation I shall be done using current Environmental Protection Agency Methods 1-5 contained in 40 CFR Part 60, Appendix A, as modified in Section II of this document.

II. Procedure for Determining Particulate Matter in the Impinger Catch (Back Half)

The analysis and calculations for Method 5 shall conform to that described by EPA in the current 40 CFR Part 60, Appendix A, except that the back half catch shall be included as particulate matter. The back half weight is the sum of the impinger catch (organic and inorganic) and the back half acetone rinse weights.

A. Sample Recovery of the Back Half

1. Purging

Whenever SO₂ interference is suspected, purge the impingers immediately after the test run is complete with N₂ or clean air for a minimum of one-half the sample volume.

2. Impinger Liquid

Measure the volume of water collected in all impingers and place the water from the first three impingers in a container. Thoroughly rinse all sample-exposed surfaces between the filter and fourth impinger with water and place in above container.

3. Acetone Rinse

Thoroughly rinse all sample-exposed surfaces between the filter and the fourth impinger with acetone and place the washings in a tared beaker to dry.

B. Analysis of the Back Half

1. Impinger Liquid Extraction

- a. Add 50-100 ml of dichloromethane to the impinger liquid.
- b. Spin for at least ten minutes.

- c. Pour the liquid into a separatory funnel and drain the organic phase into a tared beaker (organic fraction).
- d. Drain the remaining liquid into a beaker and repeat Steps a, b, and c. Perform the extraction several times with fresh dichloromethane until the organic fraction is clear. Keep each organic extraction in a separate beaker.
- e. Following the last extraction, drain the remaining liquid from the separatory funnel into a tared beaker (inorganic fraction).
- f. Allow the organic fraction beakers to dry under a hood at room temperature.
- g. Evaporate the inorganic fraction in such a manner that the beaker contents do not become exposed to temperatures greater than 212°F.
- h. Dry weighed beakers containing a sample of the acetone, dichloromethane and a sample of distilled deionized water to check for blank weight.
- i. Desiccate organic, inorganic and blank beakers for at least 24 hours at room temperature in a desiccator containing silica gel. Weigh to a constant weight and report the results to the nearest 0.1 mg. Constant weight is defined in Section 4.3 of Method 5.

2. Back Half Acetone Rinse

- a. Dry the acetone rinse in a hood at room temperature.
- b. Desiccate and weigh the beaker to constant weight and record.

C. Reagents

1. Water

Use distilled deionized water in the impingers and to rinse all glassware.

2. Acetone

Use reagent grade, \leq 0.001 percent residue in glass bottles.

3. Dichloromethane

Use reagent grade, \leq 0.001 percent residue in glass bottles.

~~FA-JSS-14107-01-15-04~~

RECEIVED



Spectrum Glass

JAN 15 2004

PUGET SOUND CLEAN
AIR AGENCY

January 13, 2004

John Schantz
Inspector
Puget Sound Clean Air Agency
110 Union Street
Suite 500
Seattle, WA 98101-2038

Subject: Recent Source Test Report

Dear Mr. Schantz,

We have completed all of the requirements of the Notice of Violation Number 3-000187. In this, we were required to perform a source test on Furnace 2 and Furnace 4.

I am sending the report on this Performance Test as requested. This report includes tests on Furnace #2 and Furnace #4. We followed the source test plan submitted and approved by you prior to testing. The results show that we are well within the allowable limits of the Order of Approval number 6497. We also showed that we were within the limits of 40CFR Subpart CC. We believe this satisfies the corrective action order described in the Notice of Violation.

Thank-You for your guidance and assistance in helping us get this done. Please advise if you have any questions or comments.

Best Regards,

Larry Witsell

Glass Technologist
Spectrum Glass Company

Cc: Fred Austin
Shorty Seel
Sherry Van Mondfrans

#14107



RECEIVED

JAN 15 2004

PUGET SOUND CLEAN
AIR AGENCY

EMISSION TEST REPORT

Particulate Matter & Opacity Emission Testing
#2 & #4 Glass Melting Furnaces

Date of Test: November 24, 2003

SPECTRUM GLASS COMPANY
Woodinville, Washington

Prepared for:

Spectrum Glass Company
24106 Snohomish-Woodinville Road
Woodinville, WA 98072-0646
(425) 483-6699

Prepared by:

TRC Environmental Corporation
19874 141st Place N.E.
Woodinville, WA 98072
(425) 489-1938

TRC Project #41613-0010-00000

January 9, 2004

EMISSION TEST REPORT

TRC PROJECT NO: 41613-0010-00000

TEST DATE: November 24, 2003

TYPE OF TESTS: Particulate Matter, Opacity

TESTED SOURCES: #2 & #4 Furnaces

TEST SITE: Spectrum Glass Company
Woodinville, WA

PREPARED FOR: Spectrum Glass Company
24106 Snohomish Woodinville Road
Woodinville, WA 98072-0646
(425) 483-6699

REPORT CERTIFICATION

SUBMITTAL DATE

January 9, 2004

This project was carried out under my direction and supervision. To the best of my knowledge, the data presented in this report is accurate and complete.



Paul J. Clark
Field Team Leader
NW Air Measurements Manager

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SECTION 1
INTRODUCTION

Spectrum Glass Company operates a glass manufacturing facility in Woodinville, Washington. Spectrum Glass Company (Spectrum Glass) contracted TRC Environmental Corporation (TRC) in Woodinville, Washington to quantify particulate matter and opacity emissions at the #2 and #4 glass melting furnace stacks on November 24, 2003. The furnaces were tested while operating at their normal production rates using electrical power and natural gas to melt and refine glass. The production rates during these emission tests were approximately 1,050 and 950 kilograms per hour (kg/hr) for Furnaces #2 and #4, respectively. These emissions tests were performed to demonstrate compliance with the requirements of the Puget Sound Clean Air Agency (PSCAA).

All testing procedures were conducted in accordance with the guidelines published in the July 2001 edition of the US Environmental Protection Agency (EPA) document Title 40, Code of Federal Regulations, Part 60 (40CFR60), Appendix A, Methods 3A, 5, 9 and 22. Method 3A(modified) was performed to quantify Oxygen and Carbon Dioxide emissions for use in molecular weight calculations. Triplicate sixty (60) minute Method 5 tests were performed on each baghouse stack. Method 5 was performed to quantify particulate matter emissions. During daylight hours, Method 9 was performed to observe visible emissions (opacity). A total of eighteen (18) minutes of opacity readings was collected (6 minutes for each emissions test). During nighttime hours Method 22 was performed to observe visible emissions. A total of six (6) minutes of continuous opacity readings was collected for each emissions test. No visible emissions were observed during performance of Method 22.

The test program is summarized in Table 1.0.

Table 1.0
Source Test Parameters and Methodology

Source(s)	Test Parameters	Test Methodology
#2 & #4 Glass Melting Furnace Baghouse Stacks	Three (3) 60-minute tests for particulate matter	EPA Method 3A(modified) EPA Method 5
#2 & #4 Baghouse Stacks (18 mins. Each)	18 minutes of 15-second opacity readings <u>OR</u>	EPA Method 9
#2 Baghouse only	6 minutes of continuous observation for opacity	EPA Method 22

The source description, test procedures and quality assurance activities are described in the subsequent sections. All supporting field data, analytical reports, calibration records, and project participants are provided in appendices.

SECTION 2

SUMMARY OF TEST RESULTS

The test crew utilized the following EPA 40 CFR 60, Appendix A Reference Methods:

- Method 3A Determination of Oxygen and Carbon Dioxide In Emissions from Stationary Sources (modified)
- Method 5 Determination of Particulate Matter Emissions from Stationary Sources
- Method 9 Visual Determination of the Opacity of Emissions From Stationary Sources
- Method 22 Visual Determination of the Fugitive Emissions From Material Sources and Smoke Emissions From Flares

Particulate matter emission concentration results are reported in grains per dry standard cubic meter (gr/dscf). Particulate matter emission rates results for are reported in pounds per hour (lb/hr) and grams per kilograms (g/kg) of flat glass produced. Opacity emissions are reported in percent (%).

For this test program, particulate matter emission results were not blank-corrected.

Section 60.296 of Subpart CC in 40CFR60 allows for a zero production correction of 454 g/hr for flat glass. When this factor is subtracted from the measured particulate matter emissions, the results are then reported as zero.

A summary of the test results as compared to the emissions limits as specified by PSCAA and 40CFR60, Subpart CC is provided in Table 2.0.

Table 2.0
Summary of Average Results and Permit Limits
#2 & #4 Glass Melting Furnace Stacks

November 24, 2003

Spectrum Glass Company
Woodinville, Washington

Test Identification	Pollutant	Emission Unit	Run 1	Run 2	Run 3	Average	Permit Limit
FURNACE #2 Method 5	Particulate Matter	gr/dscf	0.003	0.006	0.004	0.004	0.010
		lb/hr	0.134	0.286	0.212	0.210	-
		g/kg	0.058	0.124	0.092	0.091	-
		g/kg	0.0	0.0	0.0	0.0	0.225 ¹
	Volume of Gas Collected	dscf	56.756	41.924	41.302	46.601	Minimum of 30.0 dscf
Method 22	Visible Emissions	%	0	0	0	0	0
FURNACE #4 Method 5	Particulate Matter	gr/dscf	0.004	0.004	0.006	0.005	0.010
		lb/hr	0.164	0.158	0.226	0.182	-
		g/kg	0.078	0.076	0.108	0.087	-
		g/kg	0.0	0.0	0.0	0.0	0.225 ¹
	Volume of Gas Collected	dscf	38.711	37.103	36.510	37.441	Minimum of 30.0 dscf
Method 9	Opacity	%	0	0	0	0	0

¹Reported results reflect use of zero correction factor (454 g/hr subtracted from measured particulate matter) per Section 60.296 of 40CFR60, Subpart CC

SECTION 3

SOURCE PROCESS DESCRIPTION

Spectrum Glass Company operates two (2) glass melting furnaces fitted with baghouses for emission control devices (ECDs). Refer to Table 3.0 for process data recorded by the plant personnel during the emissions tests.

Table 3.0 Process Parameters

Parameter	Unit	Run 1	Run 2	Run 3	Average
FURNACE #2 Process Rate	pounds glass	2,573	2,496	2,611	2,560
Baghouse Pressure Drop	inches	4.9	4.9	4.9	4.9
Baghouse Inlet Temp	° F	252	252	252	252
Natural Gas Used	ft ³ natural gas	2,393.91	2,231.45	2,393.60	2339.65
FURNACE #4 Process Rate	pounds glass	2,199	2,164	2,199	2187
Baghouse Pressure Drop	inches	5.5	5.5	5.5	5.5
Baghouse Inlet Temp	° F	349	349	349	349
Natural Gas Used	ft ³ natural gas	2,561.58	2,231.45	2,393.60	2395.54

SECTION 4

SAMPLING AND ANALYTICAL PROCEDURES

All sampling and analytical procedures used in this test program were based on procedures published by the Environmental Protection Agency. These sampling and analytical procedures are contained in 40 CFR 60, Appendix A published by EPA. Copies of these methods are available from the EPA EMTIC electronic bulletin board or the Code of Federal Regulations.

4.1 OVERVIEW

This section describes the procedures that TRC followed during the field-sampling program. Throughout the program TRC followed *40 CFR Part 60, Appendix A* test methods.

The remainder of this section is divided into several subsections: Field Program Description, Pre-sampling Activities and Onsite Sampling Activities.

4.2 FIELD PROGRAM DESCRIPTION

TRC personnel conducted the field sampling and the following test methods from 40 CFR, Part 60, Appendix A were used:

- Method 3A Determination of Oxygen and Carbon Dioxide In Emissions from Stationary Sources (modified)
- Method 5 Determination of Particulate Matter Emissions from Stationary Sources
- Method 9 Visual Determination of the Opacity of Emissions From Stationary Sources
- Method 22 Visual Determination of the Fugitive Emissions From Material Sources and Smoke Emissions From Flares

4.3 TESTING METHODOLOGY

4.3.1 Traverse Point Location (EPA Method 1)

EPA Method 1 is performed as referenced by EPA Method 5. The procedures specified by EPA Method 1, "Sample and Velocity Traverses for Stationary Sources", were followed to determine the number and location of traverse points to be used for the stratification

testing and velocity traverses. The number of straight run stack diameters (equivalent diameters) upstream and downstream from the sample ports were used to determine the minimum number of traverse points required. Parallel or non-cyclonic gas stream flow was verified using a Type-S Pitot tube connected to an inclined-vertical oil manometer. The manometer has 0.01-inch gradations on the inclined scale and 0.10 inch gradations on the vertical scale. In practice, the Pitot tube is rotated so the planes of the face openings are perpendicular to the stack cross-sectional plane. This is referred to as the 0-degree reference position. A zero manometer reading obtained in this position indicates no cyclonic flow. If the manometer does not read zero, the Pitot tube is rotated up to a 90-degree yaw angle until a zero reading is obtained. The angle of rotation is measured to the nearest degree. All traverse points were examined in this fashion. If the average of all the rotation angles are less than 20 degrees, the reference method sampling ports was located at a point in the exhaust gas stream that is considered to be non-cyclonic.

The #2 Glass Melting Furnace stack has a 37-inch inside diameter (ID). The straight and unobstructed length of the stack before "B" the sample ports is approximately twenty feet (20') or 6.5 diameters and the straight and unobstructed distance after "A" the sample ports is approximately ten feet (10') feet or approximately 3.2 diameters. For this test program, the maximum number of traverse points or twenty four (24) traverse points were selected for sample collection to allow for sampling two and one half (2.5) minutes per point to collect the samples over a sixty (60) minute sample period.

The #4 Glass Melting Furnace stack has a 40-inch inside diameter (ID). The straight and unobstructed length of the stack before "B" the sample ports is approximately thirty feet (30') or 9.0 diameters and the straight and unobstructed distance after "A" the sample ports is approximately ten feet (10') feet or approximately 3.0 diameters. For this test program, the maximum number of traverse points or twenty four (24) traverse points were selected for sample collection to allow for sampling two and one half (2.5) minutes per point to collect the samples over a sixty (60) minute sample period.

During the Method 5 tests at each furnace, the sample probe tip was moved to the minimum number of traverse points in each of the two (2) test ports, which are located 90 degrees apart, in each of the circular stacks. At each of the furnaces, 12-point traverses were performed in each of the two test ports at 2.1, 6.7, 11.8, 17.7, 25.0, 35.6, 64.4, 75.0, 82.3, 88.2, 93.3, and 97.9 percent of the stack diameter. A copy of each stack schematic with the actual traverse points used is included in the appendices of this report.

4.3.2 Stack Gas Velocity and Volumetric Flow Rate (EPA Method 2)

EPA Method 2 is included in EPA Method 5. The procedures delineated by EPA Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type-S Pitot tube)," were followed to determine the stack gas velocity and volumetric flow rate. From the results of the measurements taken in the preceding section to determine the number and location of traverse points, a velocity and temperature traverse was conducted for each test run. A Type-S Pitot tube and K-Type thermocouple was positioned at each traverse point. The Pitot tube differential pressure and exhaust gas temperature data was recorded on field data sheets. The Pitot tube was connected to an inclined-vertical oil manometer and the thermocouple was connected digital temperature readout. The Pitot tube, thermocouple and readout devices were calibrated in accordance with US EPA requirements prior to and after field use.

4.3.3 Oxygen and Carbon Dioxide Emissions (EPA Method 3A(modified))

Molecular weight of the stack gas was determined using a modified Method 3A. EPA Method 3A "Determination of Oxygen and Carbon Dioxide Concentrations In Emissions From Stationary Sources (Instrumental Analyzer Procedure)" was modified to incorporate the use of gas sample bags. A gas sample was collected into a tedlar bag during each test run. The gas samples were later analyzed using appropriate gas analyzers in the TRC lab.

4.3.4 Stack Gas Moisture Content

The moisture content of the stack gas was determined gravimetrically from the weight gain in each impinger from the Method 5 sampling trains.

4.3.5 Particulate Matter (EPA Method 5)

The EPA Method 5 sample train (Reference Figure 5.1) consisted of a stainless steel buttonhook nozzle attached to a heated glass lined stainless steel sheath probe. A thermocouple and S-type Pitot tube are permanently attached to the probe for measurement of stack gas temperature and velocity. Sample gas was drawn through the nozzle and probe and then through a heated glass fiber filter. The gas stream temperature across the filter was kept at 248 ± 25 °F.

Particulate matter collected on the filter, within the probe, and all connecting glassware from the filter holder top to the probe end was recovered, desiccated, and weighed to determine the total particulate catch. In the TRC laboratory, reagent and filter blanks was carried throughout the gravimetric analysis procedures. Each gravimetric sample was weighed to constant weights of ± 0.5 milligrams following desiccation in a cabinet desiccator. The Mettler AB204-S electronic balance used to obtain weights is set to a time integrating mode with a readability of 0.01 milligrams. The balance is calibrated prior to every weighing session. The balance is also certified by Mettler on an annual basis. For this project, a reagent blank was also analyzed in the same manner as the samples. For this test project, particulate matter emissions results were not blank-corrected.

Upon exiting the filter, the gas was drawn through a series of four impingers. The impinger system was as follows: 1st, 2nd, and 3rd contained 100 ml of Deionized (DI) H₂O and the 4th contained approximately 200g of silica gel. This apparatus comprised the back-half portion of the sampling train. Following the impinger system the gas was

drawn through a dry gas meter, a calibrated orifice, and a leak-free pump.

Sampling was conducted isokinetically from sampling points pre-determined in EPA Method 1. A minimum of 60 minutes per test run was performed.

Leak checks on the particulate train were performed before and after each sampling run. All leak checks and leakage rates are documented on the relevant field test data sheets. Pre-run leak checks are not required by the method but are required by TRC. The pre-run leak check was performed at a minimum vacuum setting of 15 in. Hg. The acceptance criterion for the particulate train is a leak rate of 0.02 cfm at the highest vacuum obtained during the run. All leak rates must be within the method criteria in order to validate the test run.

4.3.6 Opacity Emissions (EPA Method 9)

During daylight hours EPA Method 9 opacity emissions observations were performed using procedures outlined in EPA Method 9. The observer stood at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140° sector to his back. The line of vision was perpendicular to the plume direction, and did not include more than one plume diameter. During each test, the time, estimated distance to the emission location, approximate wind direction, estimated wind speed, description of the sky condition (presence and color of clouds), and plume background were recorded on a field data sheet at the time opacity readings are initiated and completed. A total of 18 minutes of 15-second visible observations were collected at the baghouse stack before and after the emissions tests were performed.

4.3.7 Opacity Emissions (EPA Method 22)

During nighttime hours EPA Method 22 opacity emissions observations were performed using procedures outlined in EPA Method 22. The observer stood at a distance sufficient to provide a clear view of the emissions. The line of vision was perpendicular to the

to provide a clear view of the emissions. The line of vision was perpendicular to the plume direction, and did not include more than one plume diameter. When Method 9 opacity readings were unable to be performed due to nighttime hours a total of 6 minutes of continuous visible observations were collected during each test.

SECTION 5

QUALITY ASSURANCE

5.1 OVERVIEW

TRC Environmental Corporation management is fully committed to an effective Quality Assurance/Quality Control Program whose objective is the delivery of a quality product. For much of TRC's work, that product is data resulting from field measurements, sampling and analysis activities, engineering assessments, and the analysis of gathered data for planning purposes. The Quality Assurance Program works to provide complete, precise, accurate and representative data in a timely manner for each project, considering both the project's needs and budget constraints.

This section highlights the specific QA/QC procedures that were followed on this Test Program.

5.2 FIELD QUALITY CONTROL SUMMARY

5.2.1 Reagent Certifications

All reagents used for this project conform to the specifications established by the Committee on Analytical Reagents or the American Chemical Society (ACS), or the best available grade. Included in the appendices of this report are copies of the pertinent reagent certifications.

5.3 DATA REDUCTION, VALIDATION, AND REPORTING

Specific QC measures are used to ensure the generation of reliable data from sampling activities. Proper collection and organization of accurate information followed by clear and concise reporting of the data is a primary goal in all projects.

5.3.1 Data Validation

TRC supervisory and QC personnel use validation methods and criteria, appropriate to the type of data and the purpose of the measurement. Records of all data are maintained, including that judged to be an "outlying" or spurious value. The persons validating the data had sufficient knowledge of the technical work to identify questionable values.

The Field Team Leader and/or the QC Coordinator based on their review of the adherence to an approved sampling protocol and written sample collection procedure validate Field sampling data.

The following criteria was used to evaluate the field sampling data:

- Use of approved test procedures;
- Proper operation of the process being tested;
- Use of properly operating and calibrated equipment;
- Leak checks conducted before and after test.

5.3.2 Data Reporting

All data was reported in standard units depending on the measurement and the ultimate use of the data.

The bulk of the data was computer processed and reported as follows:

Exhaust Gas Stream

1. Stack exhaust
 - a. Stack exhaust flow rates (reported in dscfm and acfm)
 - b. Stack exhaust moisture content
2. Gas Diluents and Pollutants
 - a. Particulate Matter – gr/dscf, lb/hr
 - b. Opacity - %

APPENDIX A
COMPUTER PRINTOUTS OF RESULTS



TEST DATA SUMMARIES

Client: Spectrum Glass Company
Location: Woodinville, Washington
Unit: Furnace #2

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

	<u>Run 1</u>	<u>Run 2</u>	<u>Run 3</u>
Dates:	11/24/03	11/24/03	11/24/03
Barometric Pressures:	29.77	29.77	29.77

TABLE OF CONTENTS:

Data Sheet

Run Sheet - Run 1

Run Sheet - Run 2

Run Sheet - Run 3

Calculation Sheet

PM Calcs

Sampling Data Summary					
Parameter	Run 1	Run 2	Run 3		Average
Total Sampling Time, Min.	60	60	60		60
Stack Gas Oxygen Content, O2%	20.0	20.0	20.0		20.0
Stack Gas Carbon Dioxide Content, CO2%	4.0	4.0	4.0		4.0
Gas Sample Volume at Standard Conditions, cu. ft. cu. m.	56.576	41.924	41.302		46.601
	1.602	1.187	1.169		1.319
Dry Stack Gas Flow Rate (Dry, STP), dscf/min dscm/min	6,103	5,968	5,862		5,978
	173	169	166		169

TRC Environmental Corporation

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Project Number 41613-0010-00000

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EMISSION MEASUREMENTS DEPARTMENT

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Phone: (425) 489-1938
Fax: (425) 489-9564

CLIENT: Spectrum Glass Company

DATE: 11/24/03

LOCATION: Woodinville, Washington

PROJECT NO.: 41613-0010-00000

UNIT: Furnace #2

PERSONNEL: DCT/MLE

Data Input Sheet

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

Parameter	SYMBOL	UNITS				
Test Number			Run 1	Run 2	Run 3	
Test Date			11/24/03	11/24/03	11/24/03	
Start Time			1601	1725	1852	
Stop Time			1708	1830	2000	Average
Stack Diameter	ds	inches	37	37	37	
Nozzle Diameter	dn	inches	0.456	0.402	0.402	
Barometric Pressure	Pbar	inches Hg	29.77	29.77	29.77	29.77
Stack Static Pressure	Pg	inches H ₂ O	-0.50	-0.50	-0.50	-0.50
Pitot Coefficient	cp	none	0.84	0.84	0.84	0.84
Meter Calibration Factor	Y	none	0.992	0.992	0.992	
	DH@	none	1.719	1.719	1.719	
Stack Gas Oxygen Content	O ₂	percent	20.0	20.0	20.0	20.0
Stack Gas Carbon Dioxide Content	CO ₂	percent	4.0	4.0	4.0	4.0
Net Moisture Gain (Impingers w/SiGel)	Ww	grams	31.2	22.7	22.7	25.5
Average Stack Temperature	ts	degrees F	167.5	154.7	146.0	156.1
Average Meter Temperature	tm	degrees F	58.9	63.6	68.3	63.6
Avg Delta H	dH	inches H ₂ O	2.825	1.523	1.487	1.945
Average Square Root Delta H	ASR dH	inches H ₂ O	1.670	1.231	1.211	1.371
Avg Velocity Head	dP	inches H ₂ O	0.081	0.070	0.070	0.074
Average Square Root Delta P	ASR dP	inches H ₂ O	0.274	0.265	0.258	0.265
Gas Sample Volume	Vm	cubic feet	55.941	41.964	41.713	46.539
Total Sampling Time	min	minutes	60	60	60	

TRC Environmental Corp.

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CLIENT: Spectrum Glass Company

DATE: 11/24/03

LOCATION: Woodinville, Washington

PROJECT NO.: 41613-0010-00000

UNIT: Furnace #2

PERSONNEL: DCT/MLE

Field Data Run Sheets

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

RUN NO: Run 1		PAGE ONE OF ONE							
Minutes per point: 2.5		OPERATOR: Doug Towne							
number of points: 24									
POINT NUMBER	TIME	DGM READING	VEL.	Sqrt	DIFF PRESS.		STACK TEMP.	DRY GAS METER TEMP (°F)	
		INITIAL	Dp (in. H ₂ O)	Dp	DH	Sqrt.	(°F)	INLET	OUTLET
B 1	0	78.459	0.09	0.300	3.20	1.789	161	57	56
2	3		0.08	0.283	2.90	1.703	164	56	56
3	5		0.09	0.300	3.20	1.789	166	57	56
4	8		0.10	0.316	3.60	1.897	166	57	56
5	10		0.13	0.361	4.00	2.000	170	58	51
6	13		0.12	0.346	3.90	1.975	172	58	56
7	15		0.10	0.316	3.50	1.871	173	59	56
8	18		0.10	0.316	3.50	1.871	173	59	56
9	20		0.11	0.332	3.60	1.949	174	60	57
10	23		0.05	0.224	1.80	1.342	172	60	57
11	25		0.05	0.224	1.60	1.342	171	60	57
12	28		0.05	0.224	1.80	1.342	170	61	58
A 1	30		0.08	0.283	2.80	1.673	165	60	59
2	33		0.08	0.283	2.80	1.673	169	60	59
3	35		0.08	0.283	2.80	1.673	169	61	60
4	38		0.07	0.265	2.50	1.581	169	61	60
5	40		0.08	0.283	2.80	1.673	169	61	59
6	43		0.08	0.283	2.80	1.673	167	61	59
7	45		0.06	0.245	2.10	1.449	166	62	59
8	48		0.07	0.265	2.50	1.581	165	62	59
9	50		0.07	0.265	2.50	1.581	164	63	59
10	53		0.06	0.245	2.20	1.483	163	63	59
11	55		0.07	0.265	2.50	1.581	161	63	60
12	58		0.07	0.265	2.50	1.581	160	63	60
60		134.400							
Total		Total	Avg.	Avg.	Avg.	Avg.	Avg.		Avg.
60		55.941	0.08	0.274	2.825	1.670	167.5		58.9

Impinger Gain

impinger 1:	709.4	705.9	3.50	O ₂	20.0	Start Time:	1601
impinger 2:	704.5	692.9	11.70	CO ₂	4.0	Stop Time:	1708
impinger 3:	719.0	715.7	2.30				
impinger 4:	974.0	950.3	13.70			Static Pressure (Port A):	
impinger 5:	0.0	0.0	0.00			Static Pressure (Port B):	
Trap:	0.0	0.0	0.00			Static Pressure (Avg.):	-0.5
impinger 7:	0.0	0.0	0.00				
			31.20				

TRC Environmental Corp.

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Fax: (425) 489-9564

CLIENT: Spectrum Glass Company
LOCATION: Woodinville, Washington
UNIT: Furnace #2

DATE: 11/24/03
PROJECT NO.: 41613-0010-00000
PERSONNEL: DCT/MLE

Field Data Run Sheets

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

RUN NO: Run 2		PAGE ONE OF ONE							
Minutes per point: 2.5		OPERATOR: Doug Towne							
number of points: 24									
POINT NUMBER	TIME	DGM READING	VEL.	Sqrt	DIFF PRESS.		STACK TEMP.	DRY GAS METER TEMP (°F)	
		INITIAL	Dp (in. H ₂ O)	Dp	DH	Sqrt.	(°F)	INLET	OUTLET
A 1	0	134.610	0.07	0.265	1.50	1.225	166	58	58
2	3		0.07	0.265	1.50	1.225	164	58	58
3	5		0.07	0.265	1.50	1.225	160	58	58
4	8		0.07	0.265	1.50	1.225	154	60	58
5	10		0.07	0.265	1.50	1.225	153	61	58
6	13		0.07	0.265	1.50	1.225	153	63	58
7	15		0.07	0.265	1.50	1.225	152	64	58
8	18		0.07	0.265	1.50	1.225	152	65	59
9	20		0.07	0.265	1.50	1.225	152	66	60
10	23		0.06	0.245	1.30	1.140	151	67	60
11	25		0.06	0.245	1.30	1.140	151	67	61
12	28		0.07	0.265	1.50	1.225	151	68	61
B 1	30		0.04	0.200	0.84	0.917	147	65	62
2	33		0.06	0.245	1.30	1.140	153	65	63
3	35		0.07	0.265	1.52	1.233	154	66	63
4	38		0.07	0.265	1.51	1.229	155	66	63
5	40		0.08	0.283	1.72	1.311	157	69	63
6	43		0.07	0.265	1.51	1.229	159	69	63
7	45		0.07	0.265	1.51	1.229	156	70	64
8	48		0.07	0.265	1.51	1.229	156	70	64
9	50		0.09	0.300	2.00	1.414	155	71	65
10	53		0.08	0.283	1.74	1.319	154	71	65
11	55		0.08	0.283	1.80	1.342	154	71	65
12	58		0.09	0.300	2.00	1.414	154	71	65
60		176.574							
Total		Total	Avg.	Avg.	Avg.	Avg.	Avg.		Avg.
60		41.964	0.07	0.265	1.523	1.231	154.7		63.6

Impinger Gain

impinger 1:	714.9	709.2	5.70
impinger 2:	702.9	695.6	7.30
impinger 3:	705.1	703.9	1.20
impinger 4:	863.3	854.8	8.50
impinger 5:	0.0	0.0	0.00
Trap:	0.0	0.0	0.00
impinger 7:	0.0	0.0	0.00
			22.70

O₂: 20.0
CO₂: 4.0

Start Time: 1725
Stop Time: 1830

Static Pressure: -0.5

TRC Environmental Corp.

EMISSION MEASUREMENTS DEPARTMENT

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Fax: (425) 489-9564

CLIENT: Spectrum Glass Company

DATE: 11/24/03

LOCATION: Woodinville, Washington

PROJECT NO.: 41613-0010-00000

UNIT: Furnace #2

PERSONNEL: DCT/MLE

Field Data Run Sheets

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

RUN NO:		Run 3		PAGE ONE OF ONE					
Minutes per point:		2.5		OPERATOR: Doug Towne					
number of points:		24							
POINT NUMBER	TIME	OGM READING	VEL.	Sqft	DIFF PRESS.		STACK TEMP.	DRY GAS METER TEMP (°F)	
		INITIAL	Op (in. H ₂ O)	Dp	DH	Sqft.	(°F)	INLET	OUTLET
B 1	0	176.649	0.05	0.224	1.10	1.049	151	65	65
2	3		0.04	0.200	0.87	0.933	150	65	65
3	5		0.04	0.200	0.88	0.938	147	65	65
4	8		0.04	0.200	0.88	0.938	147	66	65
5	10		0.07	0.265	1.55	1.245	148	68	65
6	13		0.07	0.265	1.55	1.245	147	69	65
7	15		0.06	0.245	1.30	1.140	147	70	65
8	18		0.08	0.283	1.75	1.323	147	71	65
9	20		0.09	0.300	1.95	1.395	146	71	65
10	23		0.09	0.300	2.00	1.414	146	72	65
11	25		0.09	0.300	2.00	1.414	146	72	66
12	28		0.09	0.300	2.00	1.414	146	72	66
A 1	30		0.07	0.265	1.55	1.245	144	70	66
2	33		0.07	0.265	1.55	1.245	144	70	66
3	35		0.07	0.265	1.55	1.245	144	71	66
4	38		0.07	0.265	1.55	1.245	144	71	66
5	40		0.07	0.265	1.55	1.245	146	72	66
6	43		0.07	0.265	1.55	1.245	146	73	66
7	45		0.07	0.265	1.55	1.245	146	73	67
8	48		0.07	0.265	1.55	1.245	145	74	67
9	50		0.06	0.245	1.30	1.140	145	74	67
10	53		0.06	0.245	1.30	1.140	144	74	67
11	55		0.07	0.265	1.55	1.245	144	74	67
12	58		0.06	0.245	1.30	1.140	144	74	68
60		218.362							
Total		Total	Avg.	Avg.	Avg.	Avg.	Avg.	Avg.	Avg.
60		41.713	0.07	0.258	1.487	1.211	146.0		68.3

Impinger Gain

Impinger 1:	714.2	708.7	5.50
Impinger 2:	698.6	691.2	7.40
Impinger 3:	712.9	711.6	1.30
Impinger 4:	841.5	833.0	8.50
Impinger 5:	0.0	0.0	0.00
Trap:	0.0	0.0	0.00
Impinger 7:	0.0	0.0	0.00
			22.70

O₂: 20.0
CO₂: 4.0

Start Time: 1852
Stop Time: 2000

Static Pressure (Port A):
Static Pressure (Port B):
Static Pressure (Avg.): -0.5

TRC Environmental Corp.

EMISSION MEASUREMENTS DEPARTMENT

19874 141st Place N.E.
Woodinville, WA 98072
Phone: (425) 489-1938
Fax: (425) 489-9564

CLIENT: Spectrum Glass Company
LOCATION: Woodinville, Washington
UNIT: Furnace #2

DATE: 11/24/03
PROJECT NO.: 41613-0010-00000
PERSONNEL: DCT/MLF

Calculation Sheet

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

Parameter	SYMBOL	UNITS	Run 1	Run 2	Run 3	Average
Test Number						
Test Date			11/24/03	11/24/03	11/24/03	
Start Time			1601	1725	1852	
Stop Time			1708	1830	2000	
Calculated Data						
Nozzle Area, $A_n = 3.14159 \cdot (d_n/2)^2$	A_n	square inches	0.1633	0.1269	0.1269	0.1391
Stack Area, $A_s = 3.14159 \cdot ((D_s/12)/2)^2$	A_s	square feet	7.47	7.47	7.47	7.47
Avg Stack Temperature, $T_s = t_s + 460$	T_s	degrees Rankin	627.5	614.7	606.0	616.1
Meter Pressure, $P_m = P_b + D_h/13.6$	P_m	inches Hg	29.98	29.88	29.88	29.91
Avg Meter Temperature, $T_m = t_m + 460$	T_m	degrees Rankin	518.9	523.6	528.3	523.6
Gas Sample Volume at Standard Conditions, $V_m(\text{std}) = 528/29.92 \cdot Y \cdot V_m \cdot P_m/T_m$	$V_m(\text{std})$	cubic feet	56.576	41.924	41.302	46.601
Net Moisture Gain (Impingers w/SiGel)	W_w	grams	31.2	22.7	22.7	25.5
Volume of Water Vapor, $V_w(\text{std}) = 0.04715 \cdot W_w$	$V_w(\text{std})$	cubic feet	1.471	1.070	1.070	1.204
Moisture Fraction, $B_{ws} = V_w(\text{std})/(V_m(\text{std}) + V_w(\text{std})) \cdot 100$	B_{ws}	percent	2.53%	2.49%	2.53%	2.52%
Dry Stack Gas Molecular Weight, $M_d = (0.32 \cdot O_2) + (0.44 \cdot CO_2) + (0.28 \cdot (100 - (O_2 + CO_2)))$	M_{wd}	g/g-mole	29.44	29.44	29.44	29.44
Wet Stack Gas Molecular Weight, $M_w = M_d \cdot (1 - B_{ws}) + (18 \cdot B_{ws})$	M_{ws}	g/g-mole	29.15	29.16	29.15	29.15
Absolute Stack Pressure, $P_s = P_{bar} + P_g/13.6$	P_s	inches Hg	29.73	29.73	29.73	29.73
Stack Gas Velocity, $V_s = 85.49 \cdot C_p \cdot ASR_dP \cdot ((T_s)/(P_s) \cdot (M_w)))^{0.5}$	V_s	ft/sec	16.71	16.00	15.50	16.07
$V_{sm} = 0.3048 \cdot V_s$	V_{sm}	m/sec	5.09	4.88	4.73	4.90
Actual Stack Gas Flow Rate, $Q_a = 60 \cdot V_s \cdot A_s$	Q_a	acft/min	7488	7170	6946	7201
Stack Gas Flow Rate (STP), $Q_{sw} = 528/29.92 \cdot Q_a \cdot (P_s/T_s)$	Q_{sw}	scf/min	6262	6120	6014	6132
Dry Stack Gas Flow Rate (Dry, STP), $Q_{sd} = 528/29.92 \cdot Q_a \cdot (1 - B_{ws}) \cdot (P_s/T_s)$	Q_{sd}	dscf/min	6103	5968	5862	5978
Isokinetic Rate, $I = 100 \cdot A_s \cdot V_m(\text{std})/\text{min} \cdot (A_n/144) \cdot Q_{sd}$	I	percent	101.72	99.18	99.48	100.13
Meter Calibration (Alternate Method), $Y_{qa} = \text{Min}/V_m \cdot ((0.0319 \cdot T_m \cdot 29.92)/(D_h \cdot (P_{bar} + D_h/13.6) \cdot M_d))^{0.5} \cdot ASR_dH$	Y_{qa}	none	1.0074	0.9958	0.9907	0.9979
Meter Quality Assurance/Quality Control Check $= 100 \cdot (Y - Y_{qa})/Y$		% Difference	-1.6%	-0.4%	0.1%	-0.6% PASS

Sampling Data Summary

Parameter	SYMBOL	UNITS	Run 1	Run 2	Run 3	Average
Total Sampling Time	min	minutes	60	60	60	60
Stack Gas Oxygen Content	O_2	%	20.0	20.0	20.0	20.0
Stack Gas Carbon Dioxide Content	CO_2	%	4.0	4.0	4.0	4.0
Gas Sample Volume at Standard Conditions, $V_m(\text{std})$	$V_m(\text{std})$	cu. ft.	56.576	41.924	41.302	46.601
		cu. m.	1.602	1.187	1.169	1.319
Dry Stack Gas Flow Rate (Dry, STP), Q_{sd}	Q_{sd}	dscf/min	6103	5968	5862	5978
		dscm/min	173	169	166	169

TRC Environmental Corp.

EMISSION MEASUREMENTS DEPARTMENT

19874 141st Place N.E.
Woodinville, WA 98072
Phone: (425) 489-1938
Fax: (425) 489-9564

CLIENT: Spectrum Glass Company
LOCATION: Woodinville, Washington
UNIT: Furnace #2

DATE: 11/24/03
PROJECT NO.: 41813-0010-00000
PERSONNEL: DCT/MLE

Particulate Emission Calculation Sheet

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

Sampling Data Summary						
Parameter	SYMBOL	UNITS	Run 1	Run 2	Run 3	Average
Total Sampling Time	min	minutes	60	60	60	60
Stack Gas Oxygen Content	O ₂	percent	20.0	20.0	20.0	20.0
Stack Gas Carbon Dioxide Content	CO ₂	percent	4.0	4.0	4.0	4.0
Gas Sample Volume at Standard Conditions	Vm(std)	cubic feet	56.576	41.924	41.302	46.601
		cubic meters	1.602	1.187	1.169	1.319
Dry Stack Gas Flow Rate (Dry, STP)	Qsd	dscf/min	6103	5968	5862	5978
		dscm/min	172.8	169.0	165.9	169.2

Process Data Summary						
Parameter	UNITS	Run 1	Run 2	Run 3	Average	
Production Time	minutes	67	65	68	67	
Glass Production	pounds	2,573	2,496	2,611	2,560	
Glass Production Rate	kg/hr	1,046	1,046	1,046	1,046	
Zero Production Rate Correction - Subpart CC (Zero Used to Prevent Negs.)	g/hr	0	0	0	0	
Fuel Usage	cubic feet	2393.91	2231.45	2393.60	2339.65	

Particulate Emissions Summary					
Parameter	UNITS	Run 1	Run 2	Run 3	Average
Front-Half Particulate Matter (PM) Emissions					
Filter #	---	#110060	#110061	#110063	
Tare Weight of Filter	grams	0.3822	0.3813	0.3581	
Final Weight of Filter	grams	0.3822	0.3813	0.3582	
Net Weight of Particulate Matter	grams	0.0000	0.0000	0.0001	
Probe Rinse Section - Beaker #					
Tare Weight of Beaker	grams	#109	#508	#104	
Final Weight of Beaker	grams	66.8768	66.9267	67.1173	
Net Weight of Particulate Matter	grams	66.8809	66.9340	67.1217	
Sample Volume	milliliters	0.0041	0.0073	0.0044	
Weight/Volume of Acetone Blank	mg/ml	30	30	30	
Net Weight of Particulate Matter due to Acetone	grams	0.0000	0.0000	0.0000	
Total Front-Half Particulate Matter	grams	0.0041	0.0073	0.0045	
Back-Half Condensible Particulate Matter (CPM) Emissions					
Organic Section - Beaker #					
Tare Weight of Beaker	grams	---	#53	#55	#71
Final Weight of Beaker	grams	65.1259	67.2222	68.7585	
Net Weight of Particulate Matter	grams	65.1297	67.2281	68.7626	
Sample Volume	milliliters	0.0038	0.0059	0.0041	
Weight/Volume of CH ₂ Cl ₂ Blank	mg/ml	180	205	180	
Net Weight of Particulate Matter due to CH ₂ Cl ₂	grams	0.0000	0.0000	0.0000	
Inorganic Section - Beaker #					
Tare Weight of Beaker	grams	---	#519	#522	#201
Final Weight of Beaker	grams	108.9628	108.9934	111.6543	
Net Weight of Particulate Matter	grams	108.9643	108.9954	111.6570	
Volume of Impinger Contents	milliliters	0.0015	0.0020	0.0027	
Weight/Volume of DI H ₂ O Blank	mg/ml	490	410	430	
Weight/Volume of Particulate Matter Due to DI H ₂ O	grams	0.0000	0.0000	0.0000	
Total Back-Half Particulate Matter	grams	0.0053	0.0079	0.0068	
Total PM & CPM Emissions					
Total Net Weight of PM & CPM	mg	9.4	15.2	11.3	12.0
Emission Concentration	g/dscm	0.006	0.013	0.010	0.009
Emission Concentration	gr/dscf	0.003	0.006	0.004	0.004
Emission Rate (Per 40CFR60 Subpart CC w/o Zero Flat Glass Correction)	g/kg	0.058	0.124	0.092	0.091
Emission Rate	lb/hr	0.134	0.286	0.212	0.210
Emission Rate (assumes 24 hour per day operation)	lb/day	3.21	6.85	5.08	5.05



TEST DATA SUMMARIES

Client: Spectrum Glass Company
Location: Woodinville, Washington
Unit: Furnace #4

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

	<u>Run 1</u>	<u>Run 2</u>	<u>Run 3</u>
Dates:	11/24/03	11/24/03	11/24/03
Barometric Pressures:	29.77	29.77	29.77

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Data Sheet

Run Sheet - Run 1

Run Sheet - Run 2

Run Sheet - Run 3

Calculation Sheet

PM Calcs

Sampling Data Summary					
Parameter	Run 1	Run 2	Run 3		Average
Total Sampling Time, Min.	60	60	60		60
Stack Gas Oxygen Content, O2%	20.0	20.0	20.0		20.0
Stack Gas Carbon Dioxide Content, CO2%	4.0	4.0	4.0		4.0
Gas Sample Volume at Standard Conditions, cu. ft. cu. m.	38.711	37.103	36.510		37.441
	1.096	1.050	1.034		1.060
Dry Stack Gas Flow Rate (Dry, STP), dscf/min dscm/min	4,712	4,674	4,692		4,693
	133	132	133		133

TRC Environmental Corporation

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Project Number 41613-0010-00000

TRC Environmental Corp.

EMISSION MEASUREMENTS DEPARTMENT

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Woodinville, WA 98072
Phone: (425) 489-1938
Fax: (425) 489-9564

CLIENT: Spectrum Glass Company

DATE: 11/24/03

LOCATION: Woodinville, Washington

PROJECT NO.: 41613-0010-00000

UNIT: Furnace #4

PERSONNEL: PJC/MLE

Data Input Sheet

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

Parameter	SYMBOL	UNITS	Run 1	Run 2	Run 3	
Test Number			11/24/03	11/24/03	11/24/03	
Test Date			1601	1010	1852	
Start Time			1708	1112	2000	Average
Stop Time						
Stack Diameter	ds	inches	40	40	40	
Nozzle Diameter	dn	inches	0.456	0.456	0.456	
Barometric Pressure	Pbar	inches Hg	29.77	29.77	29.77	29.77
Stack Static Pressure	Pg	inches H ₂ O	-0.09	-0.09	-0.08	-0.09
Pitot Coefficient	cp	none	0.84	0.84	0.84	0.84
Meter Calibration Factor	Y	none	0.992	0.992	0.992	
	DH@	none	1.719	1.719	1.719	
Stack Gas Oxygen Content	O ₂	percent	20.0	20.0	20.0	20.0
Stack Gas Carbon Dioxide Content	CO ₂	percent	4.0	4.0	4.0	4.0
Net Moisture Gain (Impingers w/SiGel)	Ww	grams	43.4	43.8	42.0	43.1
Average Stack Temperature	ts	degrees F	225.5	221.3	225.8	224.2
Average Meter Temperature	tm	degrees F	56.5	60.3	60.4	59.1
Avg Delta H	dH	inches H ₂ O	1.258	1.175	1.198	1.210
Average Square Root Delta H	ASR dH	inches H ₂ O	1.121	1.081	1.092	1.098
Avg Velocity Head	dP	inches H ₂ O	0.039	0.037	0.037	0.037
Average Square Root Delta P	ASR dP	inches H ₂ O	0.193	0.191	0.192	0.192
Gas Sample Volume	Vm	cubic feet	38.248	36.935	36.347	37.177
Total Sampling Time	min	minutes	60	60	60	

TRC Environmental Corp.

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Phone: (425) 489-1938
Fax: (425) 489-9564

CLIENT: Spectrum Glass Company

DATE: 11/24/03

LOCATION: Woodinville, Washington

PROJECT NO.: 41613-0010-00000

UNIT: Furnace #4

PERSONNEL: PJC/MLE

Field Data Run Sheets

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

RUN NO:		Run 1		PAGE ONE OF ONE						
Minutes per point:		2.5		OPERATOR: Paul Clark						
number of points:		24								
POINT NUMBER	TIME	DGM , READING	VEL. Dp (in. H ₂ O)	Sqrt Dp	DIFF PRESS.		STACK TEMP. (°F)	DRY GAS METER TEMP (°F)		
		INITIAL			DH	Sqrt.		INLET	OUTLET	
B 1	0	931.945	0.04	0.200	1.30	1.140	220	52	52	
2	3		0.04	0.200	1.30	1.140	224	51	51	
3	5		0.04	0.200	1.30	1.140	226	52	52	
4	8		0.04	0.200	1.30	1.140	227	55	53	
5	10		0.04	0.200	1.30	1.140	227	57	54	
6	13		0.04	0.200	1.30	1.140	227	58	55	
7	15		0.04	0.200	1.30	1.140	227	57	54	
8	18		0.04	0.200	1.30	1.140	227	58	54	
9	20		0.04	0.200	1.30	1.140	227	57	54	
10	23		0.04	0.200	1.30	1.140	227	57	54	
11	25		0.04	0.200	1.30	1.140	225	57	54	
12	28		0.04	0.200	1.30	1.140	225	57	54	
A 1	30		0.03	0.080	0.96	0.980	223	58	56	
2	33		0.03	0.173	0.96	0.980	224	58	56	
3	35		0.04	0.200	1.30	1.140	226	60	56	
4	38		0.04	0.200	1.30	1.140	226	60	56	
5	40		0.04	0.200	1.30	1.140	226	60	57	
6	43		0.04	0.200	1.30	1.140	227	60	58	
7	45		0.04	0.200	1.30	1.140	227	60	57	
8	48		0.04	0.200	1.30	1.140	227	60	57	
9	50		0.04	0.200	1.30	1.140	226	61	58	
10	53		0.04	0.200	1.30	1.140	226	61	58	
11	55		0.04	0.200	1.30	1.140	223	61	58	
12	58		0.03	0.173	0.98	0.990	221	61	58	
	60	970.193								
	Total	Total	Avg.	Avg.	Avg.	Avg.	Avg.		Avg.	
	60	38.248	0.04	0.193	1.258	1.121	226.5		56.5	

Impinger Gain

impinger 1:	724.8	705.6	19.20
impinger 2:	709.1	697.7	11.40
impinger 3:	714.0	711.5	2.50
impinger 4:	902.1	891.8	10.30
impinger 5:	0.0	0.0	0.00
Trap:	0.0	0.0	0.00
impinger 7:	0.0	0.0	0.00

43.40

O ₂ :	20.0
CO ₂ :	4.0

Start Time:	0850
Stop Time:	0953

Static Pressure (Port A):	
Static Pressure (Port B):	
Static Pressure (Avg.):	-0.09

TRC Environmental Corp.

EMISSION MEASUREMENTS DEPARTMENT

19874 141st Place N.E.
Woodinville, WA 98072
Phone: (425) 489-1938
Fax: (425) 489-9564

CLIENT: Spectrum Glass Company
LOCATION: Woodinville, Washington
UNIT: Furnace #4

DATE: 11/24/03
PROJECT NO.: 41613-0010-00000
PERSONNEL: PJC/MLC

Field Data Run Sheets

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

RUN NO:		Run 2		PAGE ONE OF ONE					
Minutes per point:		2.5		OPERATOR: Matt Ellis					
number of points:		24							
POINT NUMBER	TIME	DGM READING	VEL.	Sqft	DIFF. PRESS.		STACK TEMP.	DRY GAS METER TEMP (°F)	
		INITIAL	Op (in. H ₂ O)	Dp	DH	Sqft.	(°F)	INLET	OUTLET
A 12	0	970.328	0.04	0.200	1.30	1.140	219	57	57
11	3		0.04	0.200	1.30	1.140	219	57	57
10	5		0.04	0.200	0.93	0.964	224	58	57
9	6		0.03	0.173	0.96	0.980	226	59	57
8	10		0.04	0.200	1.30	1.140	227	59	57
7	13		0.03	0.173	0.96	0.980	227	60	57
6	15		0.04	0.200	1.30	1.140	227	60	57
5	18		0.04	0.200	1.30	1.140	227	61	57
4	20		0.04	0.200	1.30	1.140	220	61	58
3	23		0.04	0.200	1.30	1.140	217	62	58
2	25		0.04	0.200	1.30	1.140	216	63	58
1	28		0.04	0.200	1.30	1.140	216	63	60
B 12	30		0.03	0.173	0.96	0.990	220	61	60
11	33		0.03	0.173	0.97	0.985	223	62	60
10	35		0.03	0.173	0.97	0.985	223	62	60
9	38		0.03	0.173	0.97	0.985	223	62	60
8	40		0.04	0.200	1.30	1.140	225	63	61
7	43		0.04	0.200	1.30	1.140	227	64	61
6	45		0.04	0.200	1.30	1.140	225	65	61
5	48		0.04	0.200	1.30	1.140	225	64	61
4	50		0.03	0.173	0.96	0.990	217	64	61
3	53		0.03	0.173	0.96	0.990	217	63	61
2	55		0.04	0.200	1.30	1.140	211	62	64
1	58		0.04	0.200	1.30	1.140	211	61	61
	60	1097.263							
Total		Total	Avg.	Avg.	Avg.	Avg.	Avg.		Avg.
	60	36.935	0.04	0.191	1.175	1.081	221.3		60.3

Impinger Gain

impinger 1: 725.5 704.2 21.30
 impinger 2: 701.5 691.5 10.00
 impinger 3: 716.9 714.7 2.20
 impinger 4: 938.4 928.1 10.30
 impinger 5: 0.0 0.0 0.00
 Trap: 0.0 0.0 0.00
 impinger 7: 0.0 0.0 0.00
 43.80

O₂: 20.0
 CO₂: 4.0

Start Time: 1010
 Stop Time: 1112

Static Pressure: -0.09

TRC Environmental Corp.

EMISSION MEASUREMENTS DEPARTMENT

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Woodinville, WA 98072
Phone: (425) 489-1938
Fax: (425) 489-9564

CLIENT: Spectrum Glass Company

DATE: 11/24/03

LOCATION: Woodinville, Washington

PROJECT NO.: 41613-0010-00000

UNIT: Furnace #4

PERSONNEL: PJC/ML E

Field Data Run Sheets

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

RUN NO: Run 3		PAGE ONE OF ONE							
Minutes per point: 2.5		OPERATOR: Matt Ellis							
number of points: 24									
POINT NUMBER	TIME	DGM READING	VEL.	Sqrt	DIFF PRESS.		STACK TEMP.	DRY GAS METER TEMP (°F)	
		INITIAL	Dp (in. H ₂ O)	Dp	DH	Sqrt.	(°F)	INLET	OUTLET
SW 12	0	1007.313	0.04	0.200	1.30	1.140	220	58	58
11	3		0.04	0.200	1.30	1.140	224	59	60
10	5		0.04	0.200	1.30	1.140	226	60	60
9	8		0.04	0.200	1.30	1.140	226	61	60
8	10		0.04	0.200	1.30	1.140	226	62	60
7	13		0.04	0.200	1.30	1.140	226	62	60
6	15		0.04	0.200	1.30	1.140	226	62	60
5	18		0.03	0.173	0.97	0.985	226	63	60
4	20		0.04	0.200	1.30	1.140	227	64	61
3	23		0.04	0.200	1.30	1.140	226	62	60
2	25		0.03	0.173	0.97	0.985	226	62	60
1	28		0.03	0.173	0.97	0.985	226	62	60
NW 12	30		0.03	0.173	0.97	0.985	225	60	60
11	33		0.03	0.173	0.97	0.985	224	60	60
10	35		0.04	0.200	1.30	1.140	224	60	60
9	38		0.04	0.200	1.30	1.140	224	60	60
8	40		0.03	0.173	0.97	0.985	227	60	59
7	43		0.04	0.200	1.25	1.118	229	60	60
6	45		0.04	0.200	1.25	1.118	229	60	60
5	48		0.04	0.200	1.25	1.118	229	61	60
4	50		0.04	0.200	1.30	1.140	229	61	60
3	53		0.04	0.200	1.30	1.140	227	61	59
2	55		0.04	0.200	1.30	1.140	224	61	59
1	58		0.03	0.173	0.97	0.985	222	61	59
60		1043.650							
Total		Total	Avg.	Avg.	Avg.	Avg.	Avg.		Avg.
60		36.347	0.04	0.192	1.198	1.092	225.8		60.4

Impinger Gain

Impinger 1: 709.0 702.2 5.80
 Impinger 2: 701.7 693.5 8.20
 Impinger 3: 720.8 707.7 13.10
 Impinger 4: 654.8 840.9 13.90
 Impinger 5: 0.0 0.0 0.00
 Trap: 0.0 0.0 0.00
 Impinger 7: 0.0 0.0 0.00
 42.00

O₂: 20.0 Start Time: 1852
 CO₂: 4.0 Stop Time: 2000

Static Pressure (Port A):
 Static Pressure (Port B):
 Static Pressure (Avg.): -0.08

TRC Environmental Corp.

EMISSION MEASUREMENTS DEPARTMENT

19874 141st Place N.E.
Woodinville, WA 98072
Phone: (425) 489-1938
Fax: (425) 489-9564

CLIENT: Spectrum Glass Company
LOCATION: Woodinville, Washington
UNIT: Furnace #4

DATE: 11/24/03
PROJECT NO.: 41613-0010-00000
PERSONNEL: PJC/MLE

Calculation Sheet

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

Parameter	SYMBOL	UNITS	Run 1	Run 2	Run 3	Average
Test Number						
Test Date			11/24/03	11/24/03	11/24/03	
Start Time			1601	1010	1852	
Stop Time			1708	1112	2000	
Calculated Data						
Nozzle Area, $A_n = 3.14159 \cdot (d_n/2)^2$	A_n	square inches	0.1633	0.1633	0.1633	0.1633
Stack Area, $A_s = 3.14159 \cdot (D_s/2)^2$	A_s	square feet	8.73	8.73	8.73	8.73
Avg Stack Temperature, $T_s = t_s + 460$	T_s	degrees Rankin	685.5	681.3	685.8	684.2
Meter Pressure, $P_m = P_b + D_h/13.6$	P_m	inches Hg	29.86	29.86	29.86	29.86
Avg Meter Temperature, $T_m = t_m + 460$	T_m	degrees Rankin	516.5	520.3	520.4	519.1
Gas Sample Volume at Standard Conditions, $V_m(\text{std}) = 528/29.92 \cdot Y \cdot V_m \cdot P_m / T_m$	$V_m(\text{std})$	cubic feet	38.711	37.103	36.510	37.441
Net Moisture Gain (Impingers w/SiGel)	W_w	grams	43.4	43.8	42.0	43.1
Volume of Water Vapor, $V_w(\text{std}) = 0.04715 \cdot W_w$	$V_w(\text{std})$	cubic feet	2.046	2.065	1.980	2.031
Moisture Fraction, $B_w = V_w(\text{std}) / (V_m(\text{std}) + V_w(\text{std})) \cdot 100$	B_w	percent	5.02%	5.27%	5.14%	5.15%
Dry Stack Gas Molecular Weight, $M_d = (0.32 \cdot O_2) + (0.44 \cdot CO_2) + (0.28 \cdot (100 - (O_2 + CO_2)))$	M_d	g/g-mole	29.44	29.44	29.44	29.44
Wet Stack Gas Molecular Weight, $M_w = M_d \cdot (1 - B_w) + (18 \cdot B_w)$	M_w	g/g-mole	28.87	28.84	28.85	28.85
Absolute Stack Pressure, $P_s = P_{bar} + P_g/13.6$	P_s	inches Hg	29.76	29.76	29.76	29.76
Stack Gas Velocity, $V_s = 85.49 \cdot C_p \cdot ASRdP \cdot ((T_s) / ((P_s) \cdot (M_w)))^{0.5}$	V_s	ft/sec	12.36	12.22	12.33	12.31
$V_{sm} = 0.3048 \cdot V_s$	V_{sm}	m/sec	3.77	3.73	3.76	3.75
Actual Stack Gas Flow Rate, $Q_a = 60 \cdot V_s \cdot A_s$	Q_a	acft/min	6474	6401	6458	6444
Stack Gas Flow Rate (STP), $Q_{sw} = 528/29.92 \cdot Q_a \cdot (P_s/T_s)$	Q_{sw}	scf/min	4961	4934	4946	4947
Dry Stack Gas Flow Rate (Dry, STP), $Q_{sd} = 528/29.92 \cdot Q_a \cdot (1 - B_w) \cdot (P_s/T_s)$	Q_{sd}	dscf/min	4712	4674	4692	4693
Isokinetic Rate, $I = 100 \cdot A_s \cdot V_m(\text{std}) / \min(A_n/144) \cdot Q_{sd}$	I	percent	105.36	101.80	99.80	102.32
Meter Calibration (Alternate Method), $Y_{qa} = \min(V_m / V_m(\text{std})) \cdot (0.0319 \cdot T_m^{2.9}) / (D_h \cdot (P_{bar} + d_h/13.6) \cdot M_d)^{0.5} \cdot ASRdH$	Y_{qa}	none	0.9884	0.9914	1.0176	0.9991
Meter Quality Assurance/Quality Control Check, $= 100 \cdot (Y - Y_{qa}) / Y$		% Difference	0.4%	0.1%	-2.6%	-0.7%
						PASS

Sampling Data Summary

Parameter	SYMBOL	UNITS	Run 1	Run 2	Run 3	Average
Total Sampling Time	min	minutes	60	60	60	60
Stack Gas Oxygen Content	O_2	%	20.0	20.0	20.0	20.0
Stack Gas Carbon Dioxide Content	CO_2	%	4.0	4.0	4.0	4.0
Gas Sample Volume at Standard Conditions, $V_m(\text{std})$	$V_m(\text{std})$	cu. ft.	38.711	37.103	36.510	37.441
		cu. m.	1.096	1.050	1.034	1.060
Dry Stack Gas Flow Rate (Dry, STP), Q_{sd}	Q_{sd}	dscf/min	4712	4674	4692	4693
		dscm/min	133	132	133	133

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CLIENT: Spectrum Glass Company
LOCATION: Woodinville, Washington
UNIT: Furnace #4

DATE: 11/24/03
PROJECT NO.: 41613-0010-00000
PERSONNEL: PJC/MLE

Particulate Emission Calculation Sheet

The table below contains the results of testing and calculations performed by TRC on the date(s) listed.

EPA Method 5 w/PSCAA Back-Half - Particulate Matter & Condensible Particulate Matter

Sampling Data Summary						
Parameter	SYMBOL	UNITS	Run 1	Run 2	Run 3	Average
Total Sampling Time	min	minutes	60	60	60	60
Stack Gas Oxygen Content	O ₂	percent	20.0	20.0	20.0	20.0
Stack Gas Carbon Dioxide Content	CO ₂	percent	4.0	4.0	4.0	4.0
Gas Sample Volume at Standard Conditions,	Vm(std)	cubic feet	38.711	37.103	36.510	37.441
		cubic meters	1.096	1.050	1.034	1.060
Dry Stack Gas Flow Rate (Dry, STP),	Qsd	dscf/min	4712	4674	4692	4693
		dscm/min	133.4	132.3	132.8	132.8

Process Data Summary						
Parameter	UNITS	Run 1	Run 2	Run 3	Average	
Production Time	minutes	63	62	63	63	
Glass Production	pounds	2199	2164	2199	2187	
Glass Production Rate	kg/hr	950.8	950.8	950.8	950.8	
Zero Production Rate Correction - Subpart CC (Zero Used to Prevent Negs.)	g/hr	0	0	0	0	
Fuel Usage	cubic feet	2561.58	2231.45	2393.60	2395.54	

Particulate Emissions Summary					
Parameter	UNITS	Run 1	Run 2	Run 3	Average
Front-Half Particulate Matter (PM) Emissions					
Filter #	---	#110056	#110057	#110058	
Tare Weight of Filter	grams	0.3859	0.3851	0.3843	
Final Weight of Filter	grams	0.3859	0.3851	0.3843	
Net Weight of Particulate Matter	grams	0.0000	0.0000	0.0000	
Probe Rinse Section - Beaker #					
---	---	#106	#110	#111	
Tare Weight of Beaker	grams	66.8984	65.3105	67.0751	
Final Weight of Beaker	grams	66.9058	65.3150	67.0823	
Net Weight of Particulate Matter	grams	0.0074	0.0045	0.0072	
Sample Volume	milliliters	40	40	40	
Weight/Volume of Acetone Blank	mg/ml	0.0000	0.0000	0.0000	
Net Weight of Particulate Matter due to Acetone	grams	0.0000	0.0000	0.0000	
Total Front-Half Particulate Matter	grams	0.0074	0.0045	0.0072	
Back-Half Condensible Particulate Matter (CPM) Emissions					
Organic Section - Beaker #					
---	---	#100	#101	#102	
Tare Weight of Beaker	grams	67.1051	65.4323	67.2011	
Final Weight of Beaker	grams	67.1076	65.4363	67.2040	
Net Weight of Particulate Matter	grams	0.0025	0.0040	0.0029	
Sample Volume	milliliters	190	210	175	
Weight/Volume of CH ₂ Cl ₂ Blank	mg/ml	0.0000	0.0000	0.0000	
Net Weight of Particulate Matter due to CH ₂ Cl ₂	grams	0.0000	0.0000	0.0000	
Inorganic Section - Beaker #					
---	---	#203	#204	#205	
Tare Weight of Beaker	grams	109.7129	110.9983	111.6707	
Final Weight of Beaker	grams	109.7132	110.9993	111.6739	
Net Weight of Particulate Matter	grams	0.0003	0.0010	0.0032	
Volume of Impinger Contents	milliliters	400	380	445	
Weight/Volume of DI H ₂ O Blank	mg/ml	0.0000	0.0000	0.0000	
Weight/Volume of Particulate Matter Due to DI H ₂ O	grams	0.0000	0.0000	0.0000	
Total Back-Half Particulate Matter	grams	0.0028	0.0050	0.0061	
Total PM & CPM Emissions					
Total Net Weight of PM & CPM	mg	10.2	9.5	13.3	11.0
Emission Concentration	g/dscm	0.009	0.009	0.013	0.010
Emission Concentration	g/dscf	0.004	0.004	0.006	0.005
Emission Rate (Per 40CFR60 Subpart CC w/o Zero Flat Glass Correction)	g/kg	0.078	0.076	0.108	0.087
Emission Rate	lb/hr	0.164	0.158	0.226	0.182
Emission Rate (assumes 24 hour per day operation)	lb/day	3.93	3.79	5.41	4.38

APPENDIX B

SPECTRUM GLASS COMPANY PROCESS DATA

Spectrum Glass Process Data- Furnace 4					F Daytank			Date: 11/24/2003				
Time	F4 Draw at Hood	F4 Draw at Crossover	F4 Damper Position	F4 burner Output %	Fd/t Draw at Hood	Fd/t Damper Position	Fd/t burner Output %	Baghouse Temp.	Outlet Temp.	Frequency	Blower Static Press.	Drop across Bags (dp)
1A	0.40	0.60	Open	38	DFR	DFR	DFR	348	274	45.0	6.50	5.20
2A	0.35	0.60	Open	34	DFR	DFR	DFR	348	274	45.0	6.50	5.20
3A	0.35	0.60	Open	38	DFR	DFR	DFR	363	279	45.0	6.50	5.30
4A	0.40	0.60	Open	0	DFR	DFR	DFR	379	289	45.0	6.50	5.30
5A	0.35	0.60	1/2 Open	40	DFR	DFR	DFR	350	271	45.0	6.50	5.25
6A	0.35	0.50	1/2 Open	49	DFR	DFR	DFR	349	271	45.0	6.50	5.35
7A	0.35	0.50	1/2 Open	50	DFR	DFR	DFR	348	269	45.0	6.50	5.45
8A	0.35	0.50	1/2 Open	52	DFR	DFR	DFR	349	269	45.0	6.50	5.50
9A	0.35	0.50	1/2 Open	47	DFR	DFR	DFR	348	267	45.0	6.50	5.50
10A	0.35	0.50	1/2 Open	51	DFR	DFR	DFR	348	269	45.0	6.50	5.50
11A	0.35	0.50	1/2 Open	53	DFR	DFR	DFR	350	269	45.0	6.50	5.50
12P	0.35	0.50	1/2 Open	56	DFR	DFR	DFR	349	270	45.0	6.50	5.50
1P	0.35	0.50	3/4 Open	100	DFR	DFR	DFR	349	270	45.0	6.75	5.50
2P	0.35	0.50	1/2 Open	100	DFR	DFR	DFR	350	273	45.0	7.00	5.50
3P	0.40	0.50	1/2 Open	100	DFR	DFR	DFR	350	270	45.0	7.00	5.50
4P	0.35	0.50	1/2 Open	100	DFR	DFR	DFR	349	271	45.0	7.00	5.50
5P	0.35	0.50	1/2 Open	100	DFR	DFR	DFR	347	270	45.0	6.90	5.50
6P	0.35	0.50	1/2 Open	100	DFR	DFR	DFR	349	269	45.0	6.90	5.50
7P	0.35	0.50	5/8 Open	100	DFR	DFR	DFR	349	266	45.0	6.90	5.50
8P	0.35	0.50	5/8 Open	100	DFR	DFR	DFR	349	268	45.0	6.50	5.60
9P	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10P	0.35	0.50	Open	34	DFR	DFR	DFR	349	262	45.0	6.50	5.60
11P	0.35	0.50	Open	29	DFR	DFR	DFR	348	261	45.0	6.50	5.60
12A	0.35	0.50	Open	29	DFR	DFR	DFR	348	261	45.0	6.50	5.60

Average 351 270
Standard Deviation 6.7 5.7

Furnace No. 4 Sum 9-Noon	
9 to Noon Avgs	11/24/2003
BH DP	Temp in °F
5.50	349

Spectrum Glass Process Recordings					Date: 11/24/03		
Time	Frequency	Inlet Temp.	Drop Across Bags (dp)	Blower Static Press.	F2 Burner Output %	F2 Damper Position	F2 Hood Draw
1:00 AM	37.4	213	4.90	7.5	100	1/2 Open	0.75
2:00 AM	38.2	226	5.00	7.5	100	1/2 Open	0.75
3:00 AM	38.5	225	5.00	7.5	100	1/2 Open	0.75
4:00 AM	38.1	234	5.00	7.5	100	1/2 Open	0.75
5:00 AM	35.1	230	4.10	6.5	100	1/2 Open	0.9
6:00 AM	36.6	212	4.50	7.0	100	1/2 Open	0.9
7:00 AM	37.3	191	4.50	7.0	40	1/2 Open	0.9
8:00 AM	36.8	176	5.00	7.2	17	1/2 Open	0.9
9:00 AM	36.7	202	4.80	7.2	19	Open	0.9
10:00 AM	38.6	264	5.00	7.2	45	Open	0.9
11:00 AM	38.6	270	5.00	7.3	49	Open	0.9
12:00 PM	38.9	273	5.00	7.3	45	Open	0.9
1:00 PM	38.6	263	5.00	7.5	0	Open	0.75
2:00 PM	38.5	240	5.00	7.5	0	Open	0.75
3:00 PM	38.2	229	5.00	7.5	64	1/2 Open	0.75
4:00 PM	37.8	238	4.75	7.5	45	1/2 Open	0.75
5:00 PM	37.2	216	4.75	7.5	46	1/2 Open	0.75
6:00 PM	35.4	211	4.25	6.5	49	1/2 Open	0.75
7:00 PM	36.0	210	4.25	6.5	45	1/2 Open	0.75
8:00 PM	36.4	208	4.25	6.5	49	1/2 Open	0.75
9:00 PM	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10:00 PM	34.5	214	4.00	6.5	100	1/2 Open	0.75
11:00 PM	35.1	216	4.00	6.5	100	1/2 Open	0.75
12:00 AM	34.8	206	4.00	6.5	100	1/2 Open	0.75

225 Average
24.3 Standard Deviation

Furnace No. 2 Summary	
4 to 8 PM Avgs	11/24/2003
BH DP	Temp in °F
4.45	217

APPENDIX C
MANUAL CALCULATIONS & FIELD DATA

EPA Methods 1, 2, 3A, 4 & 5 Example Calculations

Client: SPECTRUM GLASS COMPANY
Location: Woodinville, WA
Site Location: #2 Furnace
Run #: 2
Date: 11-24-03

Nomenclature:

A_d = cross-sectional area of stack, ft.²
 A_n = cross-sectional area of nozzle, ft.²
 B_{ws} = water vapor in the gas stream, proportion by volume
 C_p = pitot tube coefficient, dimensionless
 K_p = pitot tube constant = $85.49 \text{ ft/sec} \sqrt{\frac{(\text{lb/lb-mole})(\text{inches Hg})}{(^{\circ}\text{R})(\text{inches H}_2\text{O})}}$
 M_d = molecular weight of stack gas, dry basis, lb./lb.-mole
 M_s = molecular weight of stack gas, wet basis, lb./lb.-mole
= $M_d (1 - B_{ws}) + 18(B_{ws})$
 $\sqrt{\Delta P_{avg}}$ = average velocity head of stack gas, $\sqrt{\text{inches H}_2\text{O}}$
 P_s = absolute stack gas pressure, inches Hg
 P_{static} = static pressure of the stack, inches H₂O
 P_{std} = standard absolute pressure, 29.92 inches Hg
 Q_{std} = stack flow rate, dscfh
 θ = sample time, minutes
 T_s = average stack temperature, $^{\circ}\text{F}$
 T_{std} = standard absolute temperature, 528 $^{\circ}\text{R}$
 $T_{s(avg)}$ = Average absolute stack temperature, $^{\circ}\text{R} = 460 + T_s$
 V_{mstd} = corrected meter volume, dscf
 V_s = average stack gas velocity, ft./sec.
 V_{lc} = volume of water gain in the impingers, ml

1. Volume of metered sample gas at standard conditions:

$$P_{\text{meter}} = P_{\text{bar}} + \frac{\Delta H}{13.6} = \frac{29.77}{13.6} + \frac{1.523}{13.6} = \frac{29.88}{13.6} \text{ inches Hg}$$

$$V_{m(std)} = \frac{(V_m)(T_{std})(P_{\text{meter}})(Y)}{(T_m + 460)(P_{std})}$$

$$V_{m(std)} = \frac{(41.964)(528)(29.88)(0.992)}{(\frac{63.6}{13.6} + 460)(29.92)} = \frac{41.924}{13.6} \text{ dscf}$$

2. Moisture Content:

$$V_{w(\text{std})} = (0.04707 \text{ ft}^3/\text{gram water})(V_{lc}) \quad 1 \text{ gram water} \equiv 1 \text{ ml water}$$

$$V_{w(\text{std})} = (0.04707)(22.7) = 1.0685 \text{ scf}$$

$$B_{ws} = \frac{V_{w(\text{std})}}{V_{w(\text{std})} + V_{m(\text{std})}}$$

$$B_{ws} = \frac{1.0685}{1.0685 + 41.924} = 0.0249 \text{ water vapor fraction}$$
$$0.0249 \times 100\% = 2.49\% \text{ moisture}$$

3. Molecular Weight:

Dry:

$$M_d = (0.44 * \%CO_2) + (0.32 * \%O_2) + [0.28 * (100 - \%CO_2 - \%O_2)]$$
$$= (0.44 * (4.0)) + (0.32 * (20.0)) + 0.28 * (100 - 4.0 - 20.0)$$
$$= 29.44 \text{ lb/lb-mole}$$

Wet:

$$M_w = M_d * (1 - B_{ws}) + [18 * (B_{ws})]$$
$$= (29.44) * (1 - 0.0249) + [18 * (0.0249)]$$
$$= 29.16 \text{ lb/lb-mole}$$

4. Average Velocity of Stack Gas:

$$V_s = K_p * C_p * \sqrt{\Delta P_{\text{avg}}} \sqrt{\frac{T_{s(\text{avg})}}{M_w * P_s}}$$

$$P_s = P_{\text{bar}} + \frac{P_{\text{static}}}{13.6}$$

$$P_s = 29.77 + \frac{-0.50}{13.6} = 29.73$$

$$V_s = 85.49 * 0.84 * 0.265 \sqrt{\frac{614.7}{29.16 * 29.73}} = 16.00 \text{ ft/sec}$$

as gr/dscf:

0.0154 = conversion of mg to grains (gr)

1/7000 = conversion of grains to pounds

M_n = weight of particulate in mg

$$C_s = \frac{0.0154 * M_n}{V_{m(std)}} = \frac{0.0154 * 15.2}{41.924} = \underline{0.006} \text{ gr/dscf}$$

as gr/dscf @ 7% O₂:

$$C_s = \frac{(C_s \text{ as gr/dscf}) * (20.9 - 7)}{(20.9 - O_{2,measured})} = \frac{\quad * 13.9}{(20.9 - \quad)}$$

$$= \underline{NA} \text{ gr/dscf @ 7\% O}_2$$

as g/kg

E = Emission Rate of particulate matter, g/kg

C_s = concentration of particulate matter, g/dscm

Q_{std} = volumetric flow rate, dscm/hr

A = zero production rate correction, 454 g/hr for flat glass (per Subpart CC)

P = glass production rate, kg/hr

$$E = (C_s Q_{std} - A) / P$$

$$= \frac{0.013 \text{ g/dscm} * 10140 \text{ dscm/hr} - \phi \text{ g/hr}}{1045.1 \text{ kg/hr}} \quad \text{used zero } (\phi) \text{ for this calculation}$$

$$= \underline{0.124} \text{ g/kg}$$

$$\frac{\text{dscm}}{\text{hr}} = 169.0 \frac{\text{dscm}}{\text{min}} \times 60 \frac{\text{min}}{\text{hr}}$$

as lb/hour:

$$C_s = \frac{(C_s \text{ as gr/dscf}) * Q_{std} * 60}{7000} = \frac{0.006 * 5968 * 60}{7000}$$

$$= \underline{0.286} \text{ lb/hour}$$

as lb/day

$$\underline{0.286} \text{ lb/hr} * \quad \text{hr/day} = \underline{6.85} \text{ lb/day}$$

$$\frac{\text{kg}}{\text{hr}} = 2496 \text{ lbs glass production} \times \frac{1 \text{ kg}}{2.204622 \text{ lb}} \times \frac{1}{60 \text{ min}} \times 60 \frac{\text{min}}{\text{hr}} = 1045.1 \frac{\text{kg}}{\text{hr}}$$

g/kg using Subpart CC zero production correction

$$\frac{0.013 \text{ g/dscm} \times 10140 \text{ dscm/hr} - 454 \text{ g/hr}}{1045.1 \text{ kg/hr}} = \underline{0.0} \text{ g/kg}$$

5. Stack Gas Volumetric Flow Rate (standard conditions, dry basis):

$$Q_{std} = \left(\frac{528}{29.92} \right) (Q_s) \left(\frac{P_s}{T_s} \right) (1 - B_{ws}) \quad Q_s \text{ acfm} = 16.00 \frac{\text{ft}}{\text{Sec}} \times 7.47 \frac{\text{ft}^2}{\text{hr}} \times 60 \frac{\text{min}}{\text{hr}} = 7170 \text{ acfm}$$

$$Q_{std} = \left(\frac{528}{29.92} \right) * 7170 * \left(\frac{29.73}{614.7} \right) * (1 - 0.0249) = 5968 \text{ dscfm}$$

6. Percent Isokinetic:

$$I = 100 * \frac{A_s * V_{In(std)}}{\theta * A_n / 144 * Q_{sd}}$$

$$I = 100 * \frac{7.47 * 41.924}{60 * 0.1269 / 144 * 5968}$$

$$I = 99.18 \text{ percent}$$

7. Total Particulate (Front-half & Back-half) Calculations:

0.0 g Filter

0.0073 g Probe Rinse Section

< 0.0 > g Acetone Blank (____ g x 1000 g/mg / ____ mL) x ____ mL sample volume

0.0059 g Organic Section

< ____ > g CH₂Cl₂ Blank (____ g x 1000 g/mg / ____ mL) x ____ mL sample volume

0.0020 g Inorganic + Acetone Rinse Section

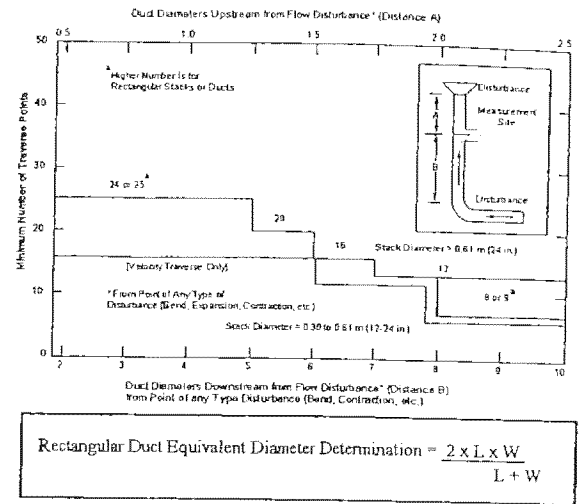
< 0.0 > g H₂O Blank (____ g x 1000 g/mg / ____ mL) x ____ mL sample volume

< 0.0 > g Acetone Blank (____ g x 1000 g/mg / ____ mL) x ____ mL sample volume

0.0152 g TOTAL Particulate Matter x $\frac{1000 \text{ g}}{\text{mg}} = 15.2 \text{ mg}$

TRAVERSE POINT LOCATION FOR CIRCULAR AND RECTANGULAR DUCTS

Project No.: 41613-0010-00000
 Client: Spectrum Glass
 Date: 11-24-03
 Sampling Location: Furnace # 2
 Internal Stack Diameter: 37"
 Nipple Length:
 Total Stack Diameter: 37"
 Nearest Upstream Disturbance (A):
 Nearest Downstream Disturbance (B):
 Calculator:



Traverse Point Number	1	2	3	4	5
	Fraction of Stack ID (1/100)	Stack ID	Traverse Point (1 x 2 = Point)	Nipple Length	Traverse Point Inside of Far Wall to Outside of Port Nipple (3 + 4 = Point)
1	.021	37.0	.78		
2	.067	"	2.48		
3	.118	"	4.37		
4	.177	"	6.55		
5	.250	"	9.25		
6	.356	"	13.17		
7	.644	"	23.83		
8	.750	"	27.75		
9	.823	"	30.45		
10	.882	"	32.63		
11	.933	"	34.52		
12	.979	"	36.22		
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					

Location of Traverse Points in Circular Stacks

(Percent of stack diameter from inside wall to traverse point)

	Number of traverse points on a diameter											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	5.7	4.4	3.2	2.6	2.1	1.3	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4			93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7
5				85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6
6					95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5
7						89.5	77.4	64.4	36.6	28.3	23.6	20.4
8							96.8	85.4	75.0	63.4	37.5	29.6
9								91.8	82.3	73.1	62.5	38.2
10									97.4	88.2	79.9	71.7
11										93.3	85.4	78.0
12											94.3	87.5
13												98.2
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												

Location of Traverse Points in Rectangular Stacks

	Number of traverse points on a diameter											
	2	3	4	5	6	7	8	9	10	11	12	
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2	
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	15.7	15.0	13.6	12.5	
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8	
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2	
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5	
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8	
7						92.9	81.3	72.2	65.0	59.1	54.2	
8							93.8	83.3	75.0	68.2	62.5	
9								94.4	85.0	77.3	70.8	
10									95.0	85.4	79.2	
11										95.5	87.5	
12											95.8	

TRC ENVIRONMENTAL CORPORATION - ISOKINETIC FLUE GAS SAMPLING DATA SHEET

Project No.: 41613-0010-00000
 Client: Spectrum Glass
 Facility: Woodinville, WA
 Source: Furnace #2
 Sample Location: Baghouse exhaust
 Stack Diameter: 37" Ø
 Date: 11/24/2003
 Run No.: 1
 Operator: Doug Towne
 Meterbox No.: 28579
 Meterbox ΔH@: 1.719
 Y Factor: 0.992

Train Prepared By: Paul Clark
 Pitot Number and Side: PI-A
 Pitot Tube Cp: 0.85
 Filter No.: 40060
 Ambient Temp., °F: 57
 Bar. Pressure, In. Hg.: 29.77
 Assumed Moisture, %: 11.24
 Heater Box Setting, °F: 248
 Nozzle # / Diam., In.: GA-7/ 0.456
 Probe Length / Material: 5 Ft Eff. Glass
 Probe Heater Setting, °F: 248

Impinger Weights
 Initial Final Weight gain
 Imp #1 705.9 705.4
 Imp #2 692.8 694.5
 Imp #3 715.7 718.0 2.3
 Imp #4 761.2 761.2
 Imp #5 760.3 761.0
 Imp #6
 Total 31.2

Method 5

Point	Clock Time		Dry Gas Meter, (ft ³)	Pitot, ΔP In. H ₂ O	Orifice ΔH, In. H ₂ O		Pump Vacuum, In. Hg	Temperatures °F							Heated Jumper	
	24-hr	Min.			Desired	Actual		Stack	Probe	Filter Box	Imp Temp	XAD Cond	Meter Inlet	Meter Outlet		Filter Outlet
A	1601	0	78.459	0.09	3.24	3.2	7.5	161	255	251	47	NA	57	56	NA	NA
2		15	80.86	0.08	2.87	2.9	7	164	255	249	43		56	56		
3		5	82.25	0.09	3.21	3.2	7	166	247	250	40		57	56		
4		10	83.76	0.1	3.57	3.6	8	166	256	252	39		57	56		
5		15	84.30	0.13	4.62	4.4	8.5	170	247	251	41		58	51		
6		20	91.05	0.12	4.27	4.2	8	172	255	251	43		58	56		
7		25	93.75	0.1	3.5	3.5	8	173	253	253	44		59	56		
8		30	96.51	0.1	3.5	3.5	8	173	247	251	44		59	56		
9		35	99.08	0.11	3.58	3.8	8	174	247	253	44		60	57		
10		40	101.76	0.05	1.77	1.8	5	172	247	252	45		60	57		
11		45	103.75	0.05	1.75	1.8	5	171	252	251	45		60	57		
12		50	105.72	0.05	1.75	1.8	5	170	246	249	44		61	58		
		55	107.649													

Comments:

Train Leak Check:
 Before Test: 0.002 Ft³ in 60 In. Hg.
 After Test: 0.005 Ft³ in 60 In. Hg.

Static Pressure
 Port Initial Final
 Pitot Tube Leak Check 0 0
 ORSAT Train Leak Check 0 0

Silica Gel Condition: Port A Port B Port C Port D

TRC ENVIRONMENTAL CORPORATION - ISOKINETIC FLUE GAS SAMPLING DATA SHEET

Project No.: 41613-0010-00000

Client: Spectrum Glass

Facility: Woodinville, WA

Source: Furnace #2

Sample Location: Baghouse exhaust

Stack Diameter: 37" Ø

Date: 11/24/2003

Run No.: 2

Operator: Doug Towne

Meterbox No.: 28579

Meterbox ΔH@: 1.719

Y Factor: 0.992

Train Prepared By: Paul Clark

Pitot Number and Side: P1-A

Pitot Tube Cp: 0.85

Filter No.: 58

Ambient Temp, °F: 29.77

Bar. Pressure, In. Hg.: 30.0

Assumed Moisture, %: 248

Heater Box Setting, °F: 647.56

Nozzle # / Diam., In.: 5 Ft Eff. Glass

Probe Length / Material: 248

Probe Heater Setting, °F: 248

Sheet 1 of 2

Method 5

Point	Clock Time		Dry Gas Meter, (ft ³)	Pitot, ΔP In. H ₂ O	Orifice ΔH, In. H ₂ O		Pump Vacuum, In. Hg	Temperatures °F						Heated Jumper	
	24-hr	Min.			Desired	Actual		Stack	Probe	Filter Box	Imp Temp	XAD Cond	Meter Inlet		Meter Outlet
1	1725	6	139.610	.07	1.44	1.50	4	166	249	254	412	NA	53	53	NA
2		28	136.750	.07	1.44	1.50	4	164	248	251	411		53	53	
3		5	137.950	.07	1.44	1.50	4	160	248	249	411		53	53	
4		7.5	139.710	.07	1.51	1.50	4	154	251	249	412		60	53	
5		10	141.465	.07	1.52	1.50	4	153	251	251	413		61	53	
6		13.5	143.280	.07	1.52	1.50	4	153	250	252	413		63	53	
7		15	145.025	.07	1.52	1.50	4	152	255	253	413		64	53	
8		18.5	146.800	.07	1.52	1.50	4	152	242	252	413		65	54	
9		20	148.970	.07	1.52	1.50	4	152	248	252	413		66	60	
10		22.5	150.590	.06	1.30	1.30	3.5	151	250	252	413		67	60	
11		25	152.005	.06	1.30	1.30	3.5	151	246	250	413		67	61	
12		27.5	153.645	.07	1.32	1.50	4	151	253	250	413		68	61	
13	1735	30	155.337												

Comments:

Train Leak Check: Before Test: 0.00A Ft³ in 60 Seconds at 15 In. Hg. After Test: 0.00A Ft³ in 60 Seconds at 6 In. Hg.

Pitot Tube Leak Check: Initial: 0 Final: 0 Port: A Static Pressure: 29.77

ORSAT Train Leak Check: Initial: 0 Final: 0 Port: A Static Pressure: 29.77

TRC ENVIRONMENTAL CORPORATION - ISOKINETIC FLUE GAS SAMPLING DATA SHEET

Project No.:	41613-0010-00000	Date:	11.24.03	Sheet	2	of	2
Client:	Spectrum Glass	Run No.:	2				
Facility:	Woodinville, WA	Sample Location:	Furnace #2				
Source:	Furnace #2	Operator:	DC 1711111111				

[illegible]

Comments:

Meter Reading

				<u>Stop</u>	<u>Restart</u>
				_____ ft ³	_____ ft ³
				In. Hg.	In. Hg.
				Seconds at _____	Seconds at _____
				Ft ³ in _____	Ft ³ in _____
				Before Test:	After Test:

IsoDataSheet with moisture, Page 2

24100 > Nonhish - Woodinville Rd

TY Woodinville	STATE WA	ZIP 98072
PHONE (KEY CONTACT)	SOURCE ID NUMBER Furnace #4	

PROCESS EQUIPMENT Batch Glass Furnace	OPERATING MODE Normal
CONTROL EQUIPMENT Blast Baghouse	OPERATING MODE Normal

DESCRIBE EMISSION POINT
Stack Exhaust

HEIGHT ABOVE GROUND LEVEL 50'	HEIGHT RELATIVE TO OBSERVER Start 20' End 20'
DISTANCE FROM OBSERVER Start 75' End 75'	DIRECTION FROM OBSERVER Start North End North

DESCRIBE EMISSIONS

Start Clear End Clear

EMISSION COLOR Start None End None	IF WATER DROPLET PLUME Attached <input type="checkbox"/> NA Detached <input type="checkbox"/>
---------------------------------------	--

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED


Start No plume End No plume


DESCRIBE PLUME BACKGROUND


Start Partly Cloudy (Sky) End Partly Cloudy

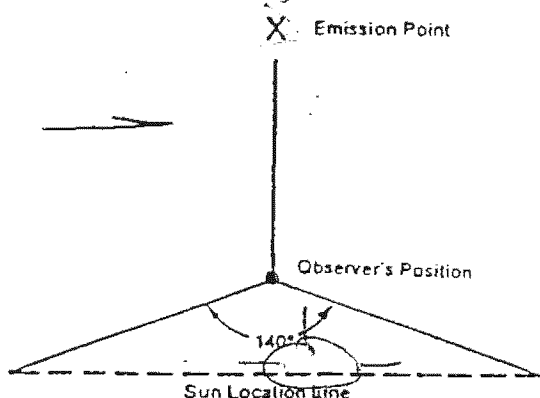
BACKGROUND COLOR Start White/Blue End White/Blue	SKY CONDITIONS Start Partly Cloudy End Partly Cloudy
WIND SPEED Start 5-10 mph End 5-10 mph	WIND DIRECTION Start End
AMBIENT TEMP Start NA End NA	WET BULB TEMP Start NA End NA
	RH, percent Start NA End NA

SOURCE LAYOUT SKETCH Draw North Arrow

Stack with Plume 

Sun 

Wind 



Emission Point


Observer's Position

Sun Location 140°

ADDITIONAL INFORMATION

MIN	0	15	30	45	COMMENTS
1	0	0	0	0	Run #1 - Start: 0900
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	
5	0	0	0	0	
6	0	0	0	0	End: 0906
7					
8					
9	0	0	0	0	Run #2 - Start: 1030
10	0	0	0	0	
11	0	0	0	0	
12	0	0	0	0	
13	0	0	0	0	
14	0	0	0	0	End: 1036
15					
16	0	0	0	0	Run #3
17	0	0	0	0	Start: 1202
18	0	0	0	0	
19	0	0	0	0	
20	0	0	0	0	
21	0	0	0	0	
22	0	0	0	0	End: 1208
23					
24					
25					
26					
27					
28					
29					
30					

OBSERVER'S NAME (PRINT)
Douglas C Towne

OBSERVER'S SIGNATURE


DATE
11-24-03

ORGANIZATION
TRC Environmental

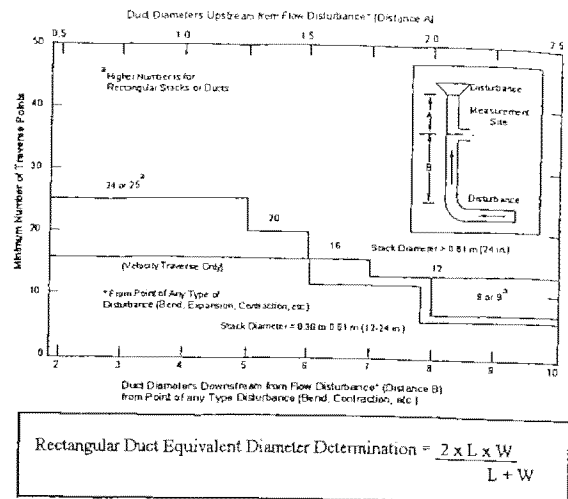
CERTIFIED BY
Yakima Clean Air Auth.

DATE

CONTINUED ON VEO FORM NUMBER

TRAVERSE POINT LOCATION FOR CIRCULAR AND RECTANGULAR DUCTS

Project No.: 41613-0010-00000
 Client: Spectrum Glass
 Date: 11-24-03
 Sampling Location: Furnace #4
 Internal Stack Diameter: 40"
 Nipple Length: 2.75"
 Total Stack Diameter: 42.75"
 Nearest Upstream Disturbance (A): _____
 Nearest Downstream Disturbance (B): _____
 Calculator: _____



Traverse Point Number	1	2	3	4	5
	Fraction of Stack ID (1/100)	Stack ID	Traverse Point (1 x 2 = Point)	Nipple Length	Traverse Point Inside of Far Wall to Outside of Port Nipple (3 + 4 = Point)
1	.021	40.0	.84	2.75	3.59
2	.067	"	2.56	"	5.31
3	.118	"	4.72	"	7.47
4	.177	"	7.08	"	9.83
5	.250	"	10.0	"	12.75
6	.356	"	14.24	"	16.99
7	.644	"	25.76	"	28.51
8	.750	"	30.0	"	32.75
9	.823	"	32.92	"	35.67
10	.882	"	35.28	"	38.03
11	.933	"	37.32	"	40.07
12	.979	"	39.16	"	41.91
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					

Location of Traverse Points in Circular Stacks

[Percent of stack diameter from inside wall to traverse point]

	Number of traverse points on a diameter											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	5.7	4.4	3.2	2.6	2.1	1.3	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.3	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

Location of Traverse Points in Rectangular Stacks

	Number of traverse points on a diameter										
	2	3	4	5	6	7	8	9	10	11	24
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	15.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	85.4	79.2
11										95.5	87.5
12											95.8

TRC ENVIRONMENTAL CORPORATION - ISOKINETIC FLUE GAS SAMPLING DATA SHEET

Project No.: 41613-0010-00000
 Client: Spectrum Glass
 Facility: Woodinville, WA
 Source: Furnace #4
 Sample Location: Baghouse exhaust
 Stack Diameter: 40" Φ
 Date: 11/24/2003
 Run No.: 1
 Operator: Mar Ellis
 Meterbox No.: 28579
 Meterbox ΔH(@): 1.719
 Y Factor: 0.992

Train Prepared By: Paul Clark
 Pitot Number and Side: P1-A
 Pitot Tube Cp: 0.85
 Filter No.: 110256
 Ambient Temp., °F: 54
 Bar. Pressure, In. Hg.: 29.77
 Assumed Moisture, %: 0
 Heater Box Setting, °F: 248
 Nozzle # / Diam., In.: GA-7/0.456
 Probe Length / Material: 5 Ft Eff. Glass
 Probe Heater Setting, °F: 248

Impinger Weights

	Initial	Final	Weight gain
Imp # 1	705.6	724.8	
Imp # 2	647.7	709.1	
Imp # 3	711.5	744.0	
Imp # 4	344.8	362.1	
Imp # 5			
Imp # 6			
Total			43.4

Method 5

Point	Clock Time		Dry Gas Meter, (ft ³)	Pitot, ΔP In. H ₂ O	Orifice ΔH, In. H ₂ O		Pump Vacuum, In. Hg	Temperatures °F							Heated Jumper	
	24-hr	Min.			Desired	Actual		Stack	Probe	Filter Box	Imp Temp	XAD Cond	Meter			Filter Outlet
													Inlet	Outlet		
A-1	0830	0	931.545	0.04	1.28	1.30	5	226	251	251	52	~61	52	~61		
2		2.5	933.457	0.04	1.28	1.30	5	224	246	252	43		51	51		
3		5	935.075	0.04	1.28	1.30	5	226	248	251	40		52	52		
4		7.5	936.680	0.04	1.28	1.30	5	227	248	252	41		53	53		
5		10	938.220	0.04	1.28	1.30	5	227	248	252	43		54	54		
6		12.5	940.045	0.04	1.28	1.30	5	227	249	251	44		55	55		
7		15	941.640	0.04	1.28	1.30	5	227	251	251	44		57	54		
8		17.5	943.235	0.04	1.28	1.30	5	227	256	252	45		58	54		
9		20	944.860	0.04	1.28	1.30	5	227	254	251	44		57	54		
10		22.5	946.520	0.04	1.28	1.30	5	227	253	245	44		57	54		
11		25	948.080	0.04	1.28	1.30	5	225	250	254	44		57	54		
12		27.5	949.610	0.04	1.28	1.30	5	225	244	252	45		57	54		
350.7	0920	30	951.346	0.03	0.96	0.96	4	223	244	252	46		57	55		
B-1	0923	30	951.346	0.03	0.96	0.96	4	223	244	252	46		57	55		

Train Leak Check:

Before Test: 0.000 Ft³ in 60
 After Test: 0.000 Ft³ in 60
 Seconds at 15 In. Hg.
 Seconds at 2 In. Hg.

Comments: Vol 344mLs

Pitot Tube Leak Check: Initial 0, Final 0
 ORSAT Train Leak Check: Initial 0, Final 0
 Static Pressure: A
 Port: A
 Inches H₂O: -0.04
 Inches Hg: 0

Silica Gel Condition: Port A 50, Port B 15, Port C 0, Port D 0

TRC ENVIRONMENTAL CORPORATION - ISOKINETIC FLUE GAS SAMPLING DATA SHEET

Project No.:

41613-0010-00000

Date:

2-5-3

Sheet

202

Client:

Spectrum Glass

Run No.:

2

Facility:

Woodinville, WA

Sample Location:

with

Source:

Furnace #4

Operator:

21 July

[illegible]

Train Leak Check During Test:

Comments:

Meter Reading

Before Test:

$$\text{Fe}^3 \text{ in}$$

Seconds at

In. Hg.

Restart ft^3

Stop t^3

Restart

Restart ft^3

In. Hg.

Stop t^3

Restart ft^3

TRC ENVIRONMENTAL CORPORATION - ISOKINETIC FLUE GAS SAMPLING DATA SHEET

Project No.: 41613-0010-000000
 Client: Spectrum Glass
 Facility: Woodinville, WA
 Source: Furnace #4
 Sample Location: Baghouse exhaust
 Stack Diameter: 40" φ
 Date: 11/24/2003
 Run No.: 2
 Operator: Matt Ellis
 Meterbox No.: 28579
 Meterbox ΔH@: 1.719
 Y Factor: 0.992

Train Prepared By: Paul Clark
 Pitot Number and Side: P1-A
 Pitot Tube Cp: 0.85
 Filter No.: 10050
 Ambient Temp., °F: 29.7
 Bar. Pressure, In. Hg.: 4
 Assumed Moisture, %:
 Heater Box Setting, °F: 248
 Nozzle # / Diam., In.: GA-7/0.456
 Probe Length / Material: 5 Ft Eff. Glass
 Probe Heater Setting, °F: 248

Impinging Weights
 Initial Final Weight gain
 704.2 725.5
 691.5 701.5
 714.7 716.9
 928.1 939.4
 43.8

Method 5

Point	Clock Time		Dry Gas Meter, (ft ³)	Pitot, ΔP In. H ₂ O	Orifice ΔH, In. H ₂ O		Pump Vacuum, In. Hg	Temperatures °F						Heated Jumper	
	24-hr	Min.			Desired	Actual		Stack	Probe	Filter Box	Imp Temp	XAD Cond	Meter Inlet		Meter Outlet
A12	1610	00	970.328	0.04	1.28	1.3	4	219	245	245	48	11A	57	57	11A
17	}	02	972.300	0.04	1.28	1.3	4	219	245	250	48		57	57	
10		05	974.050	0.04	0.93	0.93	4	224	251	251	48		58	57	
9		15	975.350	0.03	0.96	0.96	4	226	244	250	48		59	57	
9		10	976.450	0.04	0.96	1.3	4	227	248	250	48		59	57	
7		12	977.850	0.03	0.96	0.96	4	227	250	250	48		60	57	
6	}	15	979.395	0.04	1.28	1.3	4	227	250	251	47		60	57	
5		17	980.995	0.04	1.28	1.3	4	227	250	251	47		61	57	
4		20	982.400	0.04	1.28	1.3	4	220	250	249	45		61	58	
3		22	985.300	0.04	1.3	1.3	4	217	250	249	45		62	58	
2		25	986.095	0.04	1.3	1.3	4	216	250	250	45		63	58	
1	}	27	987.500	0.04	1.3	1.3	4	216	250	250	45		63	60	
Stop		1040	30	989.129	0.08		4								
B12	1	00	989.129	0.03	0.98	0.98	4	220	250	251	45		61	60	

Train Leak Check:
 Before Test: 0.001 Ft³ in 60
 After Test: 0.001 Ft³ in 60
 Seconds at 15 In. Hg.
 Seconds at 5 In. Hg.

Comments: 101 354 mba
 101 300 mba total

Pitot Tube Leak Check Initial Final
 ORSAT Train Leak Check Initial Final
 Static Pressure A
 Port Inches H₂O -0.09
 Port Inches Hg

Silica Gel Condition: Port A 8102 Port B 8102 Port C 7 Port D 7
 TRC Environmental Corp.

TRC ENVIRONMENTAL CORPORATION - ISOKINETIC FLUE GAS SAMPLING DATA SHEET

Project No.: 02398-0040-00003 Date: 24-Nov-03 Sheet 2 of 2

Client: Spectrum Glass Run No.: 2

Facility: Woodinville, WA Sample Location: Furnace #2 baghouse exhaust

Source: Furnace #2 Operator: Doug Towne p1.6115

Method 5

TRAIN METHOD:

Point	Clock Time		Dry Gas Meter, (ft ³)	Pitot, ΔP In. H ₂ O	Orifice ΔH, In. H ₂ O		Pump Vacuum, In. Hg	Temperatures °F						Heated Jumper	
	24-hr	Min.			Desired	Actual		Stack	Probe	Filter Box	Imp Temp	XAD Cond	Meter Inlet		Meter Outlet
11	1050	25	960.450	0.03	0.97	0.97	4	223	250	252	42	NA	62	60	NA
10	(5	991.995	0.03	0.97	0.97	4	223	251	252	42		62	60	
9		7.5	993.450	0.03	0.97	0.97	4	223	250	251	44		62	60	
8		10	994.700	0.04	1.29	1.3	4	225	250	251	44		63	61	
7		12.5	996.350	0.04	1.29	1.3	4	227	250	251	44		64	61	
6		15	998.150	0.04	1.29	1.3	4	225	250	253	44		65	61	
5		17.5	999.550	0.04	1.29	1.3	4	225	248	253	43		64	61	
4		20	999.995	0.03	0.98	0.98	4	217	248	253	43		64	61	
3		22.5	992.850	0.03	0.98	0.98	4	217	250	252	43		63	61	
2		25	994.300	0.04	1.31	1.3	4	211	250	252	44		62	61	
1	27.5	995.600	0.04	1.31	1.3	4	211	250	252	44	61	61			
END	1012	30	997.263												
TOTAL			36.935	0.3	Avg	1.175		221.3						60.3	

Comments:

Meter Reading

Restart

Stop

Before Test: / ft³ in / In. Hg. / ft³ / ft³

After Test: / ft³ in / In. Hg. / ft³ / ft³

Train Leak Check During Test:

TRC ENVIRONMENTAL CORPORATION - ISOKINETIC FLUE GAS SAMPLING DATA SHEET

Project No.: 41613-0010-00000
 Client: Spectrum Glass
 Facility: Woodinville, WA
 Source: Furnace #4
 Sample Location: Baghouse exhaust
 Stack Diameter: Imp #1
 Date: 11/24/2003
 Run No.: 3
 Operator: Matt Ellis
 Meterbox No.: 28579
 Meterbox ΔH @: 1.719
 Y Factor: 0.992

Train Prepared By: Paul Clark
 Pitot Number and Side: PI-A
 Pitot Tube Cp: 0.85
 Filter No.: 110058
 Ambient Temp., °F: 29.77
 Bar. Pressure, In. Hg.: 4
 Assumed Moisture, %:
 Heater Box Setting, °F: 248
 Nozzle # / Diam., In.: GA-7/0.436
 Probe Length / Material: 5 Ft Eff. Glass
 Probe Heater Setting, °F: 248

Sheet 1 of 2

Point	Clock Time		Dry Gas Meter, (ft ³)	Pitot, ΔP In. H ₂ O	Orifice ΔH, In. H ₂ O		Pump Vacuum, In. Hg	Temperatures °F						Heated Jumper	
	24-hr	Min.			Stack	Probe		Filter Box	Imp Temp	XAD Cond	Meter Inlet	Meter Outlet	Filter Outlet		
															Desired
1129	00	00	007.313	0.04	1.3	1.3	4	220	250	245	47	NA	58	58	NA
11	2.5	00	009.450	0.04	1.3	1.3	4	224	250	245	47		59	60	
10	5	00	010.850	0.04	1.25	1.3	4	226	250	245	46		60	60	
9	7.5	00	012.875	0.04	1.25	1.3	4	226	250	245	44		61	60	
8	10	00	014.880	0.04	1.25	1.3	4	226	250	247	44		62	60	
7	12.5	00	015.915	0.04	1.25	1.3	4	226	252	247	43		62	60	
6	15	00	017.300	0.04	1.25	1.3	4	226	252	247	43		62	60	
5	17.5	00	018.040	0.03	0.97	0.97	4	226	250	248	43		63	60	
4	20	00	020.280	0.04	1.25	1.3	4	227	250	248	43		64	61	
3	22.5	00	022.000	0.04	1.25	1.3	4	226	250	250	42		62	60	
2	25	00	023.300	0.03	0.97	0.97	4	226	250	250	42		62	60	
1	27.5	00	024.550	0.03	0.97	0.97	4	226	250	250	42		62	60	
1159	30	00	025.910				4	226	250	250	42		62	60	
1202	00	00	025.910	0.03	0.97	0.97	4	225	250	250	42		60	60	

Comments:
 Static Pressure: 5.4
 Port: 30.8
 Inches H₂O: -30.8
 Inches Hg: 5.4
 Pitot Tube Leak Check: Initial 4, Final 4
 ORSAT Train Leak Check: Initial 4, Final 4
 IsoData Sheet with moisture, Page 1

Before Test: 0.000 Ft³ in
 After Test: 0.000 Ft³ in
 Seconds at: 60
 In. Hg.: 15

Silica Gel Condition: Port A 5/12, Port B 5/12, Port C 5/12, Port D 5/12

TRC Environmental Corp.

TRC ENVIRONMENTAL CORPORATION - ISOKINETIC FLUE GAS SAMPLING DATA SHEET

Project No.:

41613-0010-00000

Date:

11/24/03

Sheet

2 of 2

Client:

Spectrum Glass

Run No.:

Facility:

Woodinville, WA

Sample Location:

Backhouse exhaust

Source:

Furnace #4

Operator:

三

Point	Clock Time		Dry Gas Meter, (ft ³)	Pitot, ΔP In. H ₂ O	Orifice ΔH, In. H ₂ O		Pump Vacuum, In. Hg	Temperatures °F									
	24-hr	Min.			Desired	Actual		Stack	Probe	Filter Box	Imp Temp	XAD Cond	Meter	Filter Outlet	Heated Jumper		
													Inlet			Meter Outlet	
1	1204	0625	027.500	0.03	0.77	0.97	4	224	230	248	45	N/A	60	NA			
1C		5	027.100	0.04	1.25	1.3	4	224	249	248	45		60				
7		75	036.000	0.04	1.29	1.3	4	224	249	248	45		60				
8		10	031.435	0.03	0.97	0.97	4	227	248	248	45		60				
7		125	032.780	0.04	1.26	1.25	4	229	248	250	45		60				
6		15	034.330	0.04	1.26	1.25	4	229	248	250	40		60				
5		175	035.550	0.04	1.30	1.30	4	229	248	255	47		61				
4		20	037.465	0.04	1.28	1.30	4	229	248	253	47		61				
3		225	039.000	0.04	1.28	1.30	4	227	249	253	47		61				
2		25	040.100	0.04	1.28	1.30	4	224	249	250	47		61				
1		275	042.30	0.03	0.97	0.97	4	222	250	250	47		61				
EWD	1232	30	043.600														

Train Leak Check During Test:

Meter Reading

Comments:

Before Test:

in
 3

Seconds at

11

3

After Test:

 Ft^3 in

Seconds at

三

43

29100 Snohomish - Woodville Rd

TY Woodville	STATE WA	ZIP 98072
PHONE (KEY CONTACT)	SOURCE ID NUMBER Form #2	

PROCESS EQUIPMENT Batch Colours Line	OPERATING MODE Normal
CONTROL EQUIPMENT	OPERATING MODE

DESCRIBE EMISSION POINT
Stack End

HEIGHT ABOVE GROUND LEVEL 35 ft	HEIGHT RELATIVE TO OBSERVER Start 10 ft End 10 ft
DISTANCE FROM OBSERVER Start 75 ft End 75 ft	DIRECTION FROM OBSERVER Start N End N

DESCRIBE EMISSIONS

Start Clear End Clear

EMISSION COLOR Start None End None	IF WATER DROPLET PLUME Attached <input type="checkbox"/> N/A Detached <input type="checkbox"/>
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED Start No Plume End No Plume	

DESCRIBE PLUME BACKGROUND

Start Sky End Sky

BACKGROUND COLOR Start White-Blue End Blue	SKY CONDITIONS Start Partly Cloudy End Partly Cloudy
WIND SPEED Start 5-10 mph End 5-10 mph	WIND DIRECTION Start E End E
AMBIENT TEMP Start N/A End N/A	WET BULB TEMP Start N/A End N/A
	RH, percent Start N/A End N/A

Stack with Plume

Sun

Wind

SOURCE LAYOUT SKETCH

Draw North Arrow

Emission Point

Observer's Position

140°

Sun Location Line

ADDITIONAL INFORMATION

MIN	5	15	30	45	COMMENTS
1	0	0	0	0	Start 1600
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	
5	0	0	0	0	
6	0	0	0	0	
7	0	0	0	0	
8	0	0	0	0	
9	0	0	0	0	
10	0	0	0	0	
11	0	0	0	0	
12	0	0	0	0	
13	0	0	0	0	
14	0	0	0	0	
15	0	0	0	0	
16	0	0	0	0	
17	0	0	0	0	
18	0	0	0	0	End 1618
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

OBSERVER'S NAME (PRINT)
Paul Clark

OBSERVER'S SIGNATURE
[Signature]

DATE
11/24/03

ORGANIZATION
TRC

CERTIFIED BY
YCA

DATE

CONTINUED ON VEO FORM NUMBER



Method 5/202 Data Sheet-Gravimetric Particulate Analysis

Client Name/Facility: Spectrum Glass Company Job No: 41613-0010-00000
City/State: Woodinville, WA Analytical Balance ID NO. 1121031038
Analyst: Paul Clark

Run Identification	units	Furnace #2 run # 1	Furnace #2 run # 2	Furnace #2 run # 3
Filter Analysis				
Filter Appearance				
Filter ID		110060	110061	110063
Filter Tare Weight	g	0.3822	0.3813	0.3581
Weight #1: Date/Time 12-14/1130	g	0.3820	0.3810	0.3580
Weight #2: Date/Time 12-22/0530	g	0.3821	0.3810	0.3582
Weight #3: Date/Time	g	—	—	—
PM On Filter	g			

Acetone Rinse Analysis

Dried PM Rinse Appearance				
Any Loss? If Yes, Estimate Amount	g			
Sample Volume	mL	30 mL	30	30
Beaker ID		109	508	104
Beaker Tare	g	66.8765	66.9267	67.1173
Weight #1: Date/Time 12-22/0544	g	66.8796	66.9322	67.1206
Weight #2: Date/Time 12-23/0540	g	66.8808	66.9337	67.1219
Weight #3: Date/Time 12-23/1630	g	66.8809	66.9340	67.1217
Weight #4: Date/Time	g	—	—	—
PM in Acetone Rinse	g			

Total Front-Half PM	mg			
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Organic Fraction

Dried PM Appearance				
Any Loss? If Yes, Estimate Amount	g			
Sample Volume	mL	30 mL (A) 150 mL (MCL)	45/160	30/150
Beaker ID	g	53	55	71
Beaker Tare	g	30.65.1259	67.2222	68.7585
Weight #1: Date/Time 12-23/1000	g	65.1288	67.2268	68.7628
Weight #2: Date/Time 12-23/1615	g	65.1301	67.2285	68.7626
Weight #3: Date/Time 12-24/1100	g	65.1297	67.2281	—
Weight #4: Date/Time	g	—	—	—
PM in Organic Fraction	g			

Inorganic Fraction Analysis

Dried PM Appearance				
Any Loss? If Yes, Estimate Amount	g			
Sample Volume	mL	440	410	430
Beaker ID		519	522	201
Beaker Tare	g	108.9628	108.9934	111.6543
Weight #1: Date/Time 12-22/0555	g	108.9627	108.9933	111.8650
Weight #2: Date/Time 12-23/0550	g	108.9639	108.9950	111.6570
Weight #3: Date/Time 12-23/1605	g	108.9643	108.9954	111.6570
Weight #4: Date/Time	g	—	—	—
PM in Inorganic Fraction	g			
Total Back-Half PM	g			
Total FH & BH PM	g			

QA/QC Check Completeness _____ Legibility _____ Accuracy _____

Specifications _____ Reasonableness _____

Checked by: _____ (sign) _____ (print) Date: _____

(Lab Supervisor or QA Manager)



Method 5/202 Data Sheet-Gravimetric Particulate Analysis

Client Name/Facility: Spectrum Glass Company Job No: 41613-0010-00000
City/State: Woodinville, WA Analytical Balance ID NO: 1121031038
Analyst: Paul Clark

Run Identification	units	Furnace #4 run # 1	Furnace #4 run # 2	Furnace #4 run # 3
Filter Analysis				
Filter Appearance				
Filter ID		110056	110057	110058
Filter Tare Weight	g	0.3859	0.3851	0.3843
Weight #1: Date/Time 12-14/1130	g	0.3857	0.3850	0.3840
Weight #2: Date/Time 12-22/0532	g	0.3858	0.3850	0.3841
Weight #3: Date/Time	g			
PM On Filter	g			

Acetone Rinse Analysis

Dried PM Rinse Appearance				
Any Loss? If Yes, Estimate Amount	g			
Sample Volume	mL	40	40	40
Beaker ID		106	110	111
Beaker Tare	g	66.8984	65.3105	67.0751
Weight #1: Date/Time 12-22/0545	g	66.9060	65.3150	67.0819
Weight #2: Date/Time 12-23/0545	g	66.9058	65.3150	67.0823
Weight #3: Date/Time	g			
Weight #4: Date/Time	g			
PM in Acetone Rinse	g			

Total Front-Half PM	mg			
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Organic Fraction

Dried PM Appearance				
Any Loss? If Yes, Estimate Amount	g			
Sample Volume	mL	40/150	60/150	25/150
Beaker ID	g	100	101	102
Beaker Tare	g	67.1051	65.4323	67.7041
Weight #1: Date/Time 12-23/1000	g	67.1069	65.4354	67.7040
Weight #2: Date/Time 12-23/1015	g	67.1080	65.4365	67.7040
Weight #3: Date/Time 12-24/1160	g	67.1070	65.4363	
Weight #4: Date/Time	g			
PM in Organic Fraction	g			

Inorganic Fraction Analysis

Dried PM Appearance				
Any Loss? If Yes, Estimate Amount	g			
Sample Volume	mL	400	380	445
Beaker ID		703	704	705
Beaker Tare	g	109.7129	110.9983	111.6707
Weight #1: Date/Time 12-22/0555	g	109.7128	110.9945	111.8739
Weight #2: Date/Time 12-23/0559	g	109.7132	110.9997	111.6737
Weight #3: Date/Time 12-23/1000	g		110.9993	111.6739
Weight #4: Date/Time	g			
PM in Inorganic Fraction	g			
Total Back-Half PM	g			
Total FH & BH PM	g			

QA/QC Check Completeness _____ Legibility _____ Accuracy _____

Specifications _____ Reasonableness _____

Checked by: _____ (sign) _____ (print) Date: _____

(Lab Supervisor or QA Manager)



Method 5/202 Data Sheet-Gravimetric Particulate Analysis

Client Name/Facility: Spectrum Glass Company Job No: 41613-0010-00000
City/State: Woodinville, WA Analytical Balance ID NO. 1121031038
Analyst: Paul Clark

Run Identification	units	1	2	Average
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Acetone Reagent Blank Analysis

Sample Volume	mL	100		
Beaker ID		107		
Beaker Tare	g	65.2248		
Weight #1: Date/Time 12-23/1000	g	65.2291		
Weight #2: Date/Time 12-23/1609	g	65.2288		
Weight #3: Date/Time	g			
Weight #4: Date/Time	g			
Acetone Blank Weight	g			
Wt./Vol of Acetone Blank	mg/mL			

CH₂Cl₂ Reagent Blank Analysis

Sample Volume	mL	150		
Beaker ID		108		
Beaker Tare	g	65.0435		
Weight #1: Date/Time 12-23/1020	g	65.0485		
Weight #2: Date/Time 12-23/1609	g	65.0484		
Weight #3: Date/Time	g			
Weight #4: Date/Time	g			
CH ₂ Cl ₂ Weight Blank	g			
Wt./Vol of CH ₂ Cl ₂ Blank	mg/mL			

DI H₂O Reagent Blank Analysis

Sample Volume	mL	400		
Beaker ID		212		
Beaker Tare	g	110.2026		
Weight #1: Date/Time 12-22/0555	g	110.2046		
Weight #2: Date/Time 12-23/0550	g	110.2049		
Weight #3: Date/Time	g			
Weight #4: Date/Time	g			
DI H ₂ O Blank Weight	g			
Wt./Vol of DI H ₂ O Blank	mg/mL			

QA/QC Check Completeness _____ Legibility _____ Accuracy _____

Specifications _____ Reasonableness _____

Checked by: _____ (sign) _____ (print) Date: _____

(Lab Supervisor or QA Manager)



Method 5/202 Data Sheet-Gravimetric Particulate Analysis

Client Name/Facility: Spectrum Glass Company Job No: 41613-0010-00000
City/State: Woodinville, WA Analytical Balance ID NO. 1121031038
Analyst: Paul Clark

Run Identification	units	Furnace #2 run C-1	Furnace #4 run C-1
Filter Analysis			
Filter Appearance			
Filter ID		<u>110055</u>	<u>110059</u>
Filter Tare Weight	g	<u>0.3847</u>	<u>0.3863</u>
Weight #1: Date/Time <u>12-14/1130</u>	g	<u>0.3845</u>	<u>0.3860</u>
Weight #2: Date/Time <u>12-21/1430</u>	g	<u>0.3846</u>	<u>0.3862</u>
Weight #3: Date/Time	g		
PM On Filter	g		

Acetone Rinse Analysis

Dried PM Rinse Appearance			
Any Loss? If Yes, Estimate Amount	g		
Sample Volume	mL	<u>30</u>	<u>35</u>
Beaker ID		<u>105</u>	<u>511</u>
Beaker Tare	g	<u>65.2323</u>	<u>68.8070</u>
Weight #1: Date/Time <u>12-22/0545</u>	g	<u>65.2386</u>	<u>68.8150</u>
Weight #2: Date/Time <u>12-23/0445</u>	g	<u>65.2399</u>	<u>68.8158</u>
Weight #3: Date/Time <u>12-24/1100</u>	g	<u>65.2396</u>	<u>68.8156</u>
Weight #4: Date/Time	g		
PM in Acetone Rinse	g		

Total Front-Half PM	mg		
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Organic Fraction

Dried PM Appearance			
Any Loss? If Yes, Estimate Amount	g		
Sample Volume	mL	<u>25/200</u>	<u>45/200</u>
Beaker ID	g	<u>506</u>	<u>103</u>
Beaker Tare	g	<u>66.8493</u>	<u>65.0812</u>
Weight #1: Date/Time <u>12-23/1000</u>	g	<u>66.8573</u>	<u>65.0870</u>
Weight #2: Date/Time <u>12-23/1615</u>	g	<u>66.8535</u>	<u>65.0874</u>
Weight #3: Date/Time	g		
Weight #4: Date/Time	g		
PM in Organic Fraction	g		

Inorganic Fraction Analysis

Dried PM Appearance			
Any Loss? If Yes, Estimate Amount	g		
Sample Volume	mL	<u>470</u>	<u>420</u>
Beaker ID		<u>702</u>	<u>209</u>
Beaker Tare	g	<u>109.6982</u>	<u>114.7390</u>
Weight #1: Date/Time <u>12-23/0555</u>	g	<u>109.6986</u>	<u>114.7392</u>
Weight #2: Date/Time <u>12-23/0558</u>	g	<u>109.6999</u>	<u>114.7407</u>
Weight #3: Date/Time <u>12-23/1605</u>	g	<u>109.7000</u>	<u>114.7404</u>
Weight #4: Date/Time	g		
PM in Inorganic Fraction	g		
Total Back-Half PM	g		
Total FH & BH PM	g		

QA/QC Check Completeness _____ Legibility _____ Accuracy _____

Specifications _____ Reasonableness _____

Checked by: _____ (sign) _____ (print) Date: _____
(Lab Supervisor or QA Manager)

APPENDIX D
EQUIPMENT CALIBRATION INFORMATION



S-TYPE PITOT TUBE CALIBRATION SHEET

Reference USEPA Reference Method 2 (40CFR60, App. A, Meth. 2)

PITOT SERIAL# <u>P1-A</u>	CALIBRATION DATE: <u>30-Oct-03</u>
PITOT TYPE: _____	BAROMETRIC PRESSURE: <u>759.00</u> mm Hg
STD. PITOT TYPE: _____	STATIC PRESSURE: <u>-40.6</u> mm H ₂ O
Cp(std): _____	BLOCKAGE %: <u>n/a</u>
CALIBRATED BY: _____	CORRECTION FACTOR: _____

SIDE "A" CALIBRATION				
RUN NO.	Pstd mm H ₂ O	P(s) mm H ₂ O	Cp(s)	DEVIATION Cp(s) - avg.Cp(s)
1	19.4	26.4	0.849	-0.001
2	19.4	26.4	0.849	-0.001
3	19.4	26.2	0.852	0.002
			AVERAGE	0.850

SIDE "B" CALIBRATION				
RUN NO.	Pstd mm H ₂ O	P(s) mm H ₂ O	Cp(s)	DEVIATION Cp(s) - avg.Cp(s)
1	19.4	25.6	0.8618	0.002
2	19.4	25.8	0.8585	-0.001
3	19.4	25.8	0.8585	-0.001
			AVERAGE	0.860

OVERALL AVERAGE 0.855

ACCEPTANCE CRITERIA

AVG. ICp (A) - AVG. Cp (B)	-0.0098	must be less than or equal to 0.01
Standard Deviation A =	0.0019	must be less than or equal to 0.01
Standard Deviation B =	0.0019	must be less than or equal to 0.01

If each of the above criteria are met the overall avg. Cp (Side A or Side B) may be used.

I certify that the above pitot tube was tested in accordance with the US EPA Method 2 standards.
See the Code of Federal Regulations, Title 40, Part 60, Appendix A, Method 2, Item 4.

Signature:

Date: 10-30-03

TEMPERATURE DISPLAY CALIBRATION

Meter Console Number: 28579
 Reference Calibrator Make: ALTEK
 Operator: M. Ellis

Model: 22TC Serial No.: 10931602
 Date: 2/1/03

Pretest

Thermocouple Number	Reference Temp #1	Meter temp	Criteria
T.C. # 1	100	100	0.000
T.C. #2	100	101	-0.179
T.C. #3	100	101	-0.179
T.C. #4	100	100	0.000
T.C.#5	100	100	0.000

Thermocouple Number	Reference Temp #2	Meter temp	Criteria
T.C. # 1	200	201	-0.152
T.C. #2	200	202	-0.303
T.C. #3	200	202	-0.303
T.C. #4	200	201	-0.152
T.C.#5	200	201	-0.152

Thermocouple Number	Reference Temp #3	Meter temp	Criteria
T.C. # 1	300	300	0.000
T.C. #2	300	301	-0.132
T.C. #3	300	301	-0.132
T.C. #4	300	300	0.000
T.C.#5	300	300	0.000

Thermocouple Number	Reference Temp #4	Meter temp	Criteria
T.C. # 1	400	399	0.116
T.C. #2	400	400	0.000
T.C. #3	400	400	0.000
T.C. #4	400	399	0.116
T.C.#5	400	399	0.116

Criteria: Percent difference between the Reference Temperature and the Average Temperature can only be + or - 1.5% R.

Equation:
$$\frac{(\text{Ref. Temp.} + 460) - (\text{Temp. Reading} + 460)}{(\text{Ref. Temp.} + 460)} \times 100$$

SAMPLING NOZZLE CALIBRATION

[illegible]

QA/QC

Checked By:

Date:

DOJ
0/30/03

Each diameter measured to 0.001 in.?

High to Low ≤ 0.004 in.?

Data set complete?

Nozzle number shall include material designation:

G=Pyrex glass Q=Quartz SS=Stainless steel T=Teflon

Three diameters must be measured and recorded.

TRC

Nozzle Calibrations

10/29/2003

ED 000719 00032197-00066

THERMOCOUPLE CALIBRATION FORM (for TRC SOP AM-103)

ASTM Thermometer Serial No.: 5379
 Thermocouple Calibrator
 Make: _____ Model: _____ Serial No.: _____
 Operator: Paul Clark Date: 1/6/04
 Pretest: _____ Posttest: X

Thermocouple ID	Reference Temp 1, °F	Temp. Reading 1, °F	Criteria	Criteria Met	Reference Temp 2, °F	Temp. Reading 2, °F	Criteria	Criteria Met
Meter In	63	63	± 2°F	✓				
Meter Out	63	63		✓				
Probe	63	63		✓				
Probe Heat	63	64		✓				
Imp Exit	63	62		✓				

Thermocouple ID	Reference Temp 3, °F	Temp. Reading 3, °F	Criteria	Criteria Met	Reference Temp 4, °F	Temp. Reading 4, °F	Criteria	Criteria Met

Criteria: Percent difference between the Reference Temperature and the Average Temperature can be only $\pm 1.5\%R$.

Equation:
$$\frac{[(\text{Ref. Temp.} + 460) - (\text{Temp. Reading} + 460)] \times 100}{(\text{Ref. Temp.} + 460)}$$

QA/QC Check By: D. J. Brown
 Date: 01-06-04

Figure 1. Thermocouple Calibration Sheet

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NIST-TRACEABLE CALIBRATION CERTIFICATE

Catalog Number: 17006-03
Certificate Reference Number: 4145105-00-1
Purchase Order Number: JAASLAND72403

Unit Under Test 1: 08003-53
Description: Erco ASTM Glass Thermometer; range 18
- 89F; total immersion; 379 mm total length
Serial Number 1: 5379
Equipment Condition: USED

Certificate
Completed
for: TRC ENVIRONMENTAL CORP
19501 144TH AVENUE NE
D 700
WOODINVILLE WA 98072

InnoCal certifies that the calibration of the listed units, used procedure number MWI-17006-03 with equipment traceable to the National Institute of Standards and Technology (NIST), and the test was performed in accordance with ANSI/NCSL Z540-1, ISO 17025.

Calibration has shown the equipment to meet with manufacturer tolerances listed on the next page.

Actual uncertainties available upon request.

Calibration Standards Used				
Manufacturer	Function Performed	Model Number	Serial Number	Due Date
Burns Engineering	Platinum Resistance Probe	3925	403541	10/30/03
Erco/Hart	Temperature Indicator	850	155	11/11/03

Lab Technician: 321

Date Completed: 07/25/2003

Issue Date: 07/25/2003

Received Date: 07/21/2003

This certificate shall not be reproduced except in full and requires written approval from InnoCal.
* Results data shown relates only to above listed item(s).

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NIST-TRACEABLE CALIBRATION CERTIFICATE

Catalog Number 17006-03

Certificate Reference Number 4145105-00-1

Instrument Tolerance

Unit 1: 1.1 scale division

Measured In:	Equipment "As Found"				Equipment "As Left"		
	Test Points	Reading	Deviation	O.C.T.	Test Points	Reading	Deviation
°F	32.155	32.0	-0.155	┘	32.155	32.0	-0.155
°F	54.903	55.0	0.097	┘	54.903	55.0	0.097
°F	83.345	83.4	0.055	┘	83.345	83.4	0.055

**** Note **** Check mark under the O.C.T. column indicates the equipment is Out Of Tolerance.

This certificate was performed under the climate controlled lab conditions of: 20 °C 57 %RH 995 mbar

Additional Comments:

This certificate shall not be reproduced except in full and requires written approval from Innocal.
* Results data shown relates only to above listed item(s).

EMISSION MEASUREMENT CENTER
APPROVED ALTERNATIVE METHOD (ALT-011)

ALTERNATIVE METHOD 2
THERMOCOUPLE CALIBRATION PROCEDURE

INTRODUCTION

In EPA Method 2, EPA recommended the use of an extrapolation technique for a simplified, post-test, thermocouple calibration procedure using a two point calibration: (1) ice bath and (2) boiling water. Because of the inherent accuracy and precision of the thermocouple within $\pm 1.3^{\circ}\text{F}$ in the range of -32°F to 2500°F , the two-point post-test calibration procedure may be replaced with a single-point check.

A single-point calibration procedure that checks the operation of a thermocouple system within ± 1.0 percent of the absolute measured temperature is all that is necessary to check the system for the presence of disconnected wire junctions, other loose connections, or a potential miscalibrated emf readout. A system that performs accurately at one temperature is expected to behave similarly at other temperatures.

Therefore, an alternative to the Method 2, two-point, thermocouple calibration can be used and the procedure is as follows:

ALTERNATIVE POST-TEST AND RECOMMENDED PRETEST CALIBRATION PROCEDURE

After each test run series, check the accuracy (and, hence, the calibration) of each thermocouple system at ambient temperature, or any other temperature, within the range specified by the manufacture, using a reference thermometer (either ASTM reference thermometer or a thermometer that has been calibrated against an ASTM reference thermometer). The temperatures of the thermocouple and reference thermometers shall agree to within $\pm 2^{\circ}\text{F}$.

A crimp in the connecting wires or crossed lines that change the location of the reference junction will affect readings. Check the continuity of the thermocouple by subjecting it to a change in the temperature (e.g., removing it from the stack or touching an ice cube). This step will also check for loose connections and reversed connections (noted by a wrong change in the temperature).

To ensure linearity of the measurements, it is recommended that the emf meter be originally calibrated against a NIST traceable or a comparable voltage source at several points covering the range of intended use, e.g., 0, 500, 1000, and 2000°F .

REFERENCE

1. Shigehara, R.T., E.W. Stewart, Kenneth Alexander, "Simplified Thermocouple Calibration Procedure", Entropy, Incorporated, contained in the EMTIC TSAR Library.

PRETEST METER BOX CALIBRATION

Meter No.	28579
Pbar:	30.03

Calibration Test Meter (CTM)		Date:	2/27/2003
SDGM Serial No.:	971654	Operator:	M. Ellis

Delta H	Time (min)		Meter Volume	Temperatures, °F		CTM Volume	CTM Temp., °F	CTM Y _d	CTM Flow Rate (SCFM)
				Meter In	Meter Out				
0.5	15.00	Start	192.667	80	70	904.298	66		
				81	71		66		
				81	71		66		
		Stop	198.965	81	71	910.407	66		
Total Average			6.298	75.75		6.109	66.00	0.998500	0.410
1.0	15.00	Start	201.745	86	72	913.097	67		
				88	74		67		
				89	75		68		
		Stop	210.420	89	75	921.506	68		
Total Average			8.675	81.00		8.409	67.50	0.998500	0.562
1.5	15.00	Start	215.287	88	76	926.232	69		
				92	77		69		
				92	77		69		
		Stop	225.978	92	77	936.602	69		
Total Average			10.691	83.88		10.370	69.00	0.998500	0.692
2.0	15.00	Start	229.880	94	78	940.392	69		
				94	78		69		
				95	79		69		
		Stop	242.160	95	79	952.305	69		
Total Average			12.280	86.50		11.913	69.00	0.998500	0.795
3.0	15.00	Start	260.552	89	74	970.362	69		
				89	74		69		
				92	75		69		
		Stop	275.482	92	75	984.982	69		
Total Average			14.930	82.50		14.620	69.00	0.998500	0.975

Acceptable Tolerances:
Y = +/- 0.02 from the average
dH@ = +/- 0.2 from the average

t	dH	Y	Variation	Delta H@	Variation
1	0.5	0.9853	-0.0065	1.656	-0.0636
2	1.0	0.9902	-0.0015	1.743	0.0235
3	1.5	0.9921	0.0003	1.722	0.0024
4	2.0	0.9958	0.0041	1.733	0.0139
5	3.0	0.9954	0.0036	1.743	0.0238
Average	Average	0.9916		1.719	
			PASSED		PASSED

POST TEST METER BOX CALIBRATION

Meter No.	28579
Pbar:	30.12

Calibration Test Meter (CTM)		Date:	12/29/2003
SDGM Serial No.:	28610	Operator:	M.Ellis

Delta H	1.0	Start	Meter Volume	Temperatures, °F		CTM Volume	CTM Temp., °F	CTM Y _d	CTM Flow Rate (SCFM)			
				Meter In	Meter Out							
			Time (min)	15.00	Stop	240.498	69	64	185.578	63		
							74	65		63		
77	65						63					
249.005	77	66				194.004	63					
Total Average			8.507	69.63		8.426	63.00	0.999000	0.570			
Delta H	1.0	Start	Meter Volume	Temperatures, °F		CTM Volume	CTM Temp., °F	CTM Y _d	CTM Flow Rate (SCFM)			
				Meter In	Meter Out							
			Time (min)	15.00	Stop	249.005	77	66	194.004	63		
							78	68		63		
78	68						63					
257.585	78	68				202.468	63					
Total Average			8.580	72.63		8.464	63.00	0.999000	0.573			
Delta H	1.0	Start	Meter Volume	Temperatures, °F		CTM Volume	CTM Temp., °F	CTM Y _d	CTM Flow Rate (SCFM)			
				Meter In	Meter Out							
			Time (min)	15.00	Stop	257.585	78	68	202.468	63		
							78	68		63		
80	69						63					
266.227	80	69				210.971	63					
Total Average			8.642	73.75		8.503	63.00	0.999000	0.576			

Acceptable Tolerances:

Y = +/-5% of Pretest Y

Pretest Y- 5% 0.942

Pretest Y 0.992

Pretest Y + 5% 1.041

dH	Y	Variation
1.0	0.9996	-0.0009
1.0	1.0012	0.0007
1.0	1.0007	0.0002
Average	1.0005	
PASSED		

APPENDIX E
PROJECT PARTICIPANTS

1

PROJECT PARTICIPANTS

Spectrum Glass Company

Mr. Larry Witsell, Glass Technologist

Ms. Sherry Van Mondfrans, Environmental & Safety Manager

Puget Sound Clean Air Agency (PSCAA)

Mr. Fred Austin, P.E., Source Test Engineer

Mr. John Schantz, Inspector

TRC Environmental Corporation

Mr. Wesley D. Snowden, Senior Program Manager

Mr. Paul Clark, Field Team Leader / NW Air Measurements Manager

Mr. Doug Towne, Sample Team Member / Project Manager

Mr. Matt Ellis, Sample Team Member

Ms. Judy Aasland, Report Preparation and Senior Project Assistant

YAKIMA REGIONAL CLEAN AIR AUTHORITY
NORTHWEST OPACITY CERTIFICATION
CERTIFICATE OF COMPLETION
PLUME EVALUATION TRAINING

Paul Clark

EPA REFERENCE METHOD 9

YES

CERTIFICATE NO

WA-S97-23

EXPIRATION DATE

3/4/2004




BEARER'S SIGNATURE


PROGRAM COORDINATOR
NORTHWEST OPACITY CERTIFICATION

YAKIMA REGIONAL CLEAN AIR AUTHORITY
NORTHWEST OPACITY CERTIFICATION
CERTIFICATE OF COMPLETION
PLUME EVALUATION TRAINING

DOUG TOWNE

EPA REFERENCE METHOD 9 YES
CERTIFICATE NO 1499
EXPIRATION DATE 3/11/2004


BEARER'S SIGNATURE

PROGRAM COORDINATOR
NORTHWEST OPACITY CERTIFICATION

